



Editorial

YOU will have noticed in recent issues of Radio and Hobbies a definite leaning towards equipment, either for construction or merely in the news, capable of giving radio and record reproduction over an increasing frequency range.

The truth is that the rebirth of the "Hi-Fi" era which came upon us about 10 years ago is now well in evidence. Except that whereas in those earlier years we talked about high fidelity in terms of say 50-7500 cycles, today we are inclined to go down to about 30 cycles or even lower, and have actually

seen in action disc records which have recorded as high as 20,000 cycles.

The amplifiers we used in the past were quite good, but not to be compared with that described in our two last issues either in frequency response or harmonic distortion.

Gramophone pick-ups are also in the process of great improvement to keep pace with the better records we have, and the even better types we expect to have before very long.

To date we have tested out a number of excellent loud speakers which are capable of reproducing a greater proportion of the musical range we have catered for in pick-ups, records, and amplifiers. Although from the average man's point of view, they have lagged somewhat behind the other components, they are definitely very much on the up-grade in quality and in price.

What I am waiting for, however, is more evidence that these improved components will be available with a "Made in Australia" label, and not all imported from overseas.

So far, very few designs have been made to produce a really high-grade pick-up here. There is, in fact, only one manufacturer who has equalled the performance of the best imported models, and his results are so good that I cannot believe Australians cannot do the job just as well as anyone else. Who is to be first with a sample of an Australian-made pick-up to sell for about £5, which will really do justice to a wide frequency range? There is a big market for such an item.

In loud speaker design, as judged on announced models, we are lagging in the high-grade field. The bigger 12-inch speakers, when they can be bought at all, are substantially the same as they have been for many years, and not nearly good enough to do justice to the remainder of the sound reproducing chain. There are of course, heavy demands on the materials and labor available for making standard speakers, particularly for small sets, in which field all manufacturers are doing well. But where is the successor to the many fine 12-inch speakers of the past? We must have them if high quality sound is to be a reality with Australian components.

We have a sufficiently intimate knowledge of the technical ability and industrial resources of our speaker manufacturers to realise that they know what is required, and have a pretty good idea of how to go about producing it. We will count it a red letter day when we are able to hitch up a completely Australian-made system which will equal the results obtainable now only by using imported units.

I know I am voicing the views of thousands when I venture to hope that before the end of this year, our desire will become a reality. For our part, any serious attempts to produce these badly wanted items will receive all the support we can give them. Let us hope we will not have long to wait.

John Moyle

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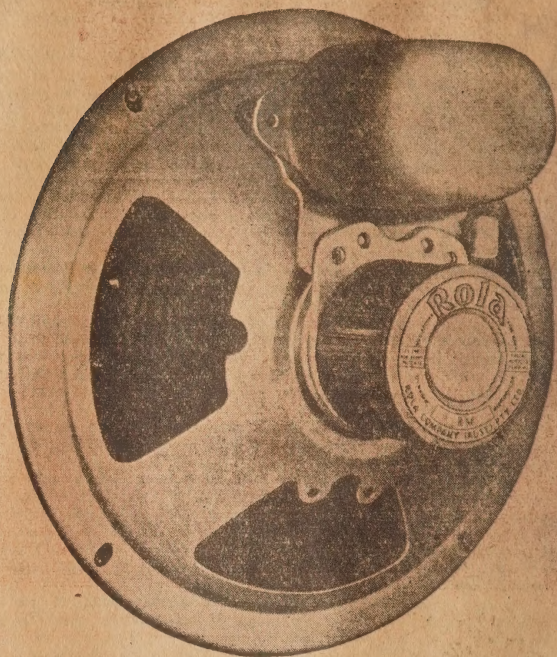
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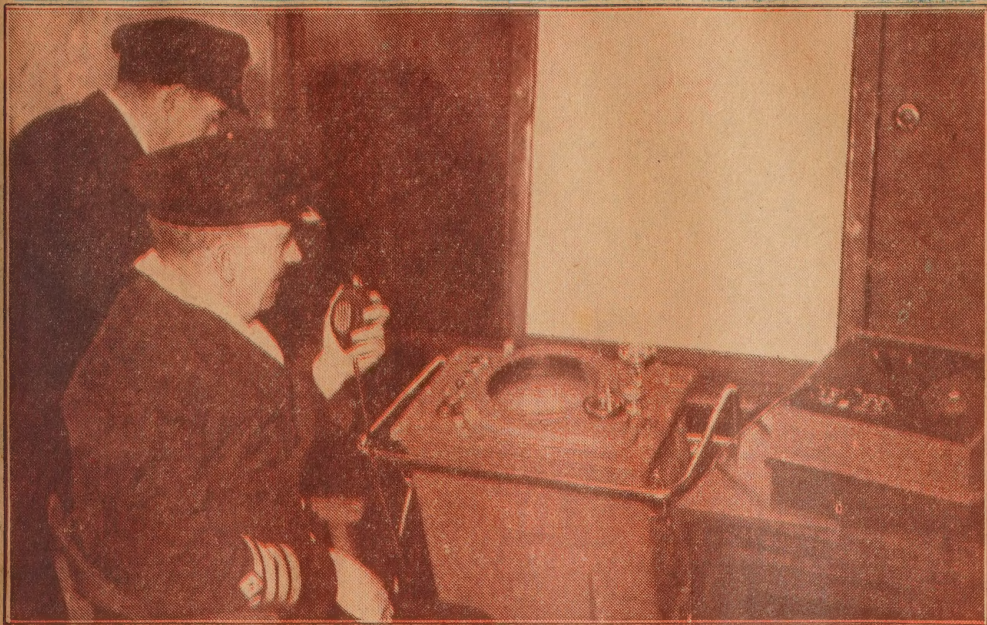


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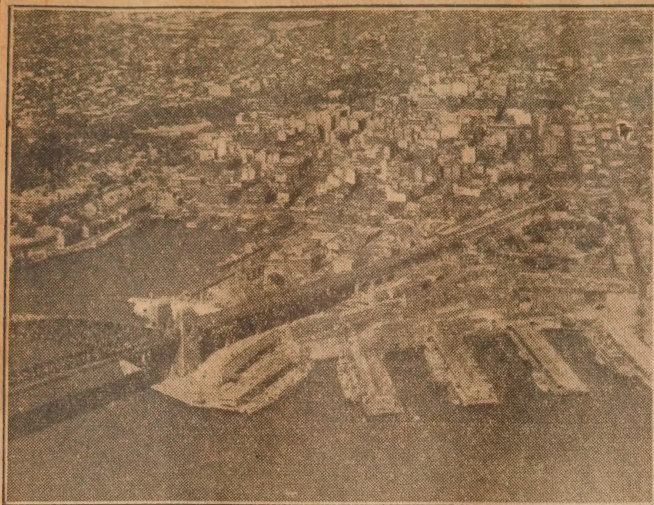
FIRST RADAR FOR HARBOR CONTROL



The use of radar to control shipping is making steady strides overseas. With his radar screen in front of him the harbor master at Douglas, Isle of Man, gives a course by radio to an incoming ship through fog.



At the end of the Victoria Pier, Douglas, a 60ft. high scanning tower overlooks the harbor, allowing a radar plan with ranges of .8, 1.2 or 3 miles to be shown on the screen.



Can we fight wars with germs? Would such weapons destroy both attacker and attacked? These questions and others are answered in the following article based on an official report issued by the National Research Council of America.

BEHIND guarded laboratory doors, as World War II ended, finishing touches were being applied to a new and untried weapon—an instrument of mass annihilation comparable to the atom-bomb. Bacterial warfare, no longer a fantasy of sensational fiction, was ready for action.

Today, any country bent on aggression could launch a germ offensive overnight. Few countries upon the globe would make a more tempting target than the United States.

So that Americans may know what we face, and what can be done about it, military authorities recently approved publication of one of the most remarkable documents that ever passed possession in this or any other country. Originally prepared for the National Research Council — and kept secret for five years — a printed, 89-page wartime report reveals exactly what the objectives and technique of biological warfare would be, what germs would be used, and what countermeasures would be available to the defence.

Strategic aims of germ war would be to knock out the enemy's troops and all the complex home-front organisation needed to support them in modern war; munitions factories, home industries, transportation lines and power plants. Any "terror" effect upon civilian morale would be purely incidental to this fundamental purpose, whose speedy accomplish-

ment should suffice to crush an enemy's resistance and dictate the terms of his surrender.

Spearhead of a germ offensive, the report anticipates, would be specially fitted aircraft bearing capacity loads of bacteria-laden dust. Transoceanic and carrier-borne planes, adaptable with equal ease, could be equipped like the aeroplanes used for crop-dusting. Over the target area, their crews could spread a blanket of the lethal powder at a height beyond the range of effective anti-aircraft

by Alden P.
Armagnac

(Popular Science)

fire, unheard and unseen from the ground. Slowly settling, the invisible dust would descend upon crowded city streets and military encampments in sufficient concentration to launch a deadly epidemic. To vary the technique, planes might use a harmless-looking smoke screen of a standard type such as titanium chloride, whose particles would actually be teeming with germs.

While these raiders were rendering a city's air unfit to breathe, others would attack its water supply with "germ bombs" — thin-walled glass capsules filled with germs or toxin and designed to burst under gas pressure, after being dropped in reservoirs.

Far from a fantastic idea, it would be perfectly feasible and perhaps militarily useful for planes to toss out screened cages that would open automatically on reaching earth, liberating swarms of plague-bearing insects that would spread disease by their bites. Air bombs of fragmentation type, shrapnel shells, and hand grenades might carry germs to complicate the injuries they inflict, if the highly resistant spores of some

bacilli could withstand the explosion of a projectile.

Not only would human beings be attacked. Animals furnishing meat and milk, and food and in-

Closely settled areas, such as Australian cities, would be ideal targets for germ warfare. To destroy them would paralyse the country.

dustrial crops, would be certain targets of a total germ war.

What particular germs would be used? Weighing the pros and cons of known human maladies from a cold-blooded military standpoint, the authors of the report—Drs. Theodor Rosebury and Elvin A. Kabat, of Columbia University College of Physicians and Surgeons—reach surprising conclusions.

Some of the most dreaded scourges of mankind, including cholera, tetanus, typhoid, and smallpox, head a list called clearly unsuitable for use in warfare. Sure protection by preventive measures, such as vaccination, rules them out. Others are eliminated as not "catching" enough, too easily cured, or impossible to spread artificially. There remain exactly 21 diseases affecting man that might be expected to be used in combat.

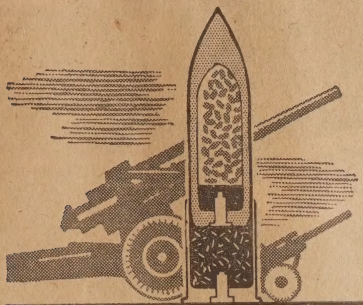
Often mentioned in past discussions of biological warfare, the germ of botulism, or canned-food poisoning, produces the deadliest stomach poison known to man. Drop 350 pounds of it into a 10,000,000-gallon reservoir, and one sip of the water would be fatal! It might be done in wartime, Drs. Rosebury and Kabat anticipate. But constant tests made by inoculating white mice with the water would immediately detect the toxin; mice can survive less than 1/100 of the lethal human dose. Warned in time, users could make the water perfectly safe to drink simply by boiling it.

"Almost ideal choices" for bacterial warfare, in odd contrast, prove to be the measles and the mumps! In-

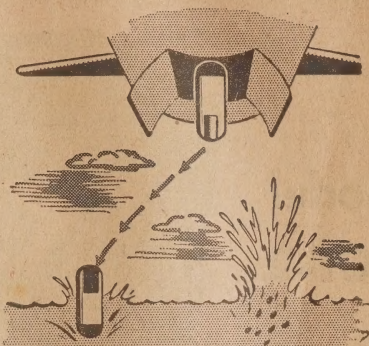
TRUTH ABOUT GERM WAR

HOW GERM WEAPONS WOULD BE USED

WEAPONS



Projectiles may scatter germs, if experiments confirm the ability of some kinds of spores to withstand the heat and pressure of detonation.

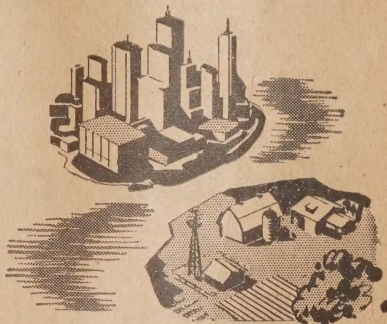


Glass "bombs," weighted to turn over in water, loose germs or toxin when burst by gas pressure generated as in inverted fire extinguisher.

TARGETS



U. S. is setup for germ attack. Hitting only 33 key points would strike a third of country's population and paralyze half of our factories.



Great cities rank as top-priority targets for planes sowing human epidemics. Other types of germs can be used against animals and crops.

COUNTER-MEASURES



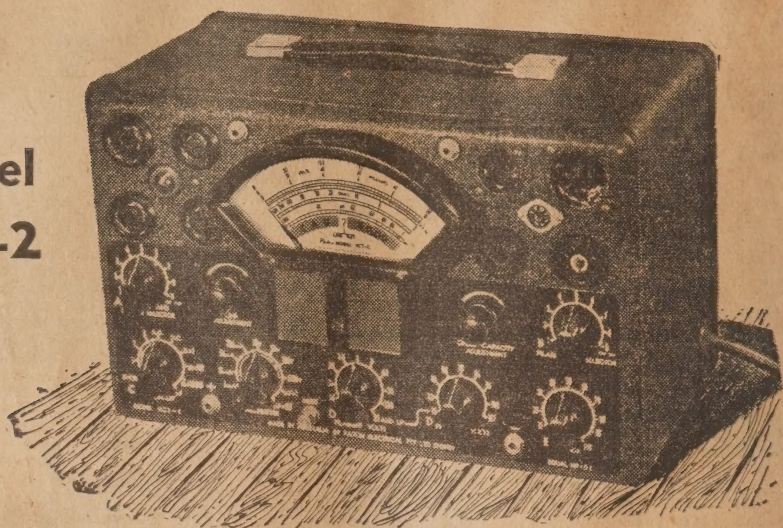
Specialists in diagnosing rare diseases, and experts constantly testing water supply on white mice, will lead defense against germ war.



Decontamination squads must sterilize everything that falls from air—including enemy planes shot down, which may be germ-laden.

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produced on a fighting front by picked troops, who have recovered from these so-called "childhood" diseases, the germs would work havoc among the defenders, while the attackers would be immune. Disabling your foe may be just as effective as killing him, to win a battle or a campaign.

Strange and little-known maladies may figure prominently in germ war, the report indicates: parrot fever, or psittacosis; "Rift Valley fever," of which there was an African epidemic in 1930; and others such as the mysterious and usually fatal Far Eastern disease, melioidosis, of which available medical literature records only 95 cases up to 1933. Readily obtainable from biological laboratories, these viruses and bacilli would rate high in military favor, since difficulty in diagnosing rare diseases would hamper defence efforts to control an epidemic.

COMMON GERMS

Better-known germs that might be unleashed against a populace include those of anthrax, influenza, meningitis, and pneumonic plague, the last called a "superlative" weapon. A single bacillus of pneumonic plague can kill a guinea pig and, the report states, "there seems no reason to believe man less susceptible." The germs could be released from planes in heavy smoke that would not only take effect in the open air, but would also penetrate closed windows.

When Major L. A. Fox, of the US Army Medical Corps, wrote in 1933 that bacterial warfare seemed to him of doubtful feasibility, he was fully justified by the state of medical knowledge at that time, the Rosebury-Kabat report states. Later developments have changed all that. By way of example, yellow fever has long been thought transmissible only by the bite of the tropical *Aedes aegypti* mosquito. But accidental cases of infection among laboratory workers handling the concentrated virus of yellow fever, in the form of a dry powder, now lead to the remarkable conclusion that it can be contracted simply by breathing air containing the organisms. Implications are startling. Hitherto the disease has been limited to equatorial regions, which provided the climate required by its mosquito carriers. Now, virus-spreading planes might introduce yellow fever anywhere on earth.

A BOOMERANG

Much has been made in the past of the argument that an attacker would hesitate to use germ warfare for fear that it would boomerang upon his own forces, if they entered the affected area. That argument, shaky at best, falls down completely for a geographically isolated target—an island naval or air base, say—that the attacker simply wants to put out of business, with no intention of occupying it. An attack upon Hawaii with malaria-bearing mosquitoes (unknown there, despite a favorable climate) might mean a second Pearl Harbor.

SUN-SPOTS ARE ON DECLINE

VARIED EFFECTS ON HUMAN AFFAIRS

For the next five or six years cyclones on the sun will be fewer and smaller. The 11-year sunspot cycle has passed its maximum and now is declining, it has been announced by the US Bureau of Standards.

THIS might be very momentous news, if its import were thoroughly understood. Sunspots have a certain and predictable effect on radio transmission. They almost certainly have a profound effect—although very complicated and little understood—on weather everywhere. Sensational claims have been made that they are in some way the determining factor in business, politics and the mass human irritability that causes wars.

These black patches, thousands of miles in area, that move across the face of the sun are believed to be great eddies in the sun's atmosphere of flaming gases. From them great streams of electrified particles are shot out into space in all directions. These streams change the electrical pattern of the earth's atmosphere, the determining factor in long-distance radio transmission.

This effect is the primary interest of the Bureau of Standards. The ionosphere, the electrical roof of the world from which radio waves are reflected, will become less dense. More and more radio wave-lengths will escape into space. The overall effect, bureau experts say, will be to jam all radio communication into an ever narrowing band of frequencies for world-wide transmission. These effects can be predicted three months in advance.

In a time of sunspot maximum, the

surface of the sun is a little cooler and hence less heat is radiated into space. This does not mean, however, that temperatures on earth will be lower. That depends on local conditions, according to the Smithsonian Institute which has carried on studies of the relations between weather and solar radiation for 40 years.

The other effects claimed are, of course, highly theoretical. It can be shown statistically, if one picks the right statistics, that most of the world's troubles, from wars to divorces, have reached their peaks when the numbers of these black solar cyclones have been greatest. The two world wars, for example, started near sunspot maximum. The alleged profound effects on human affairs might be considered as secondary to the effects on weather and hence on crops. They might be due directly to the effects on human emotions of increased numbers of electrified particles in the atmosphere.

The world's official sunspot count is made at the Zurich, Switzerland, observatory where systematic observation of solar phenomena began in the middle of the last century. The Bureau of Standards receives the Zurich reports by radio and supplements them with data from observatories in this country.

Likewise, on a larger scale, America's isolation by two oceans now becomes a liability rather than an asset to defence. It renders this country peculiarly vulnerable to all types of germ attack that might be launched from the safety of another continent. That its mere size would offer any protection is a dangerous fallacy. Actually a third of its population, and half of its industries huddle together in 33 key locations totalling less than two per cent of its land area! Our own Department of Commerce saves any potential enemy's general staff the trouble of mapping the targets in order of priority, according to number of industrial workers: No. 1, New York City-Newark-Jersey City; No. 2, Chicago; and so on, down to No. 33, Toledo. Raiders could hardly ask a more perfect setup.

RETRIBUTION

Until we can abolish war altogether, there is only one way we can prevent that nightmare from coming true, Drs. Rosebury and Kabat declare. It lies in grim preparedness to guarantee an aggressor a double dose of his own medicine—to promise retribution in kind, so swift, so sure and so terrible as to banish any temp-

tation to attack us with germs. Just such a warning from President Roosevelt and Prime Minister Churchill, they point out, stopped Axis use of poison gas in World War II, for the enemy well knew we could and would carry it out.

Fortunately we are prepared today to back up a similar ultimatum against germ warfare, as a result of top-secret biological research by the Army at Camp Detrick, Md., and by the Navy at the University of California. We can preserve the lead in research that insures our safety, just so long as Americans support these programmes.

Some years ago, tons of dynamite exploded in a railway tunnel in the Swiss Alps. Houses 20 miles away were shaken, but villages a few miles further on heard nothing. Then came reports that the explosion had been heard 100 miles away. The Swiss Meteorological Institute found it was in reality an echo caused by sound waves which had travelled upwards into a heavy cloud formation and had been amplified and reflected to points 100 miles from their source.



Technical Review

IMPROVEMENTS TO ELECTRON MICROSCOPE

Experiments with a new "double lens" system at the RCA Princeton Laboratories promise to extend considerably the possibilities of the electron microscope. The new system provides an exceptional degree of light contrast in photographing viruses and bacteria at electronic magnification up to 300,000 times actual size.

"THE enhancement of the de-tailed contrast is so great," says Dr. Hillier, of RCA Laboratories, "that information often can be obtained in thick specimens which ordinarily would give only a diffused blur on electron micrographs. As this work continues, it will have important bearing on the whole problem of virus infection."

The viewer makes possible direct observations of electron microscope images at magnifications from 200,000 to 300,000 times the dimensions of specimens. It was explained that this high magnification gives the operator the opportunity to detect defects which might ultimately spoil the micrograph. Such things as broken membranes or other flaws in the specimen can thus be seen for the first time with this device.

The simplicity of the new deflection focusing system was emphasised

by comparing it to a rangefinder employed in a conventional camera.

The electron microscope specimen is alternately illuminated from two directions with a result that if the instrument is out of focus the final image appears doubled; the two images are displaced in proportion to the amount that the instrument is out of focus. Thus, to focus with this system the operator merely adjusts the focusing control until the two images are accurately superimposed.

This new method of focusing, it is explained, facilitates the operation to such an extent that even an inexperienced operator can obtain good images. Coupled with the high magnification viewer, this system is said to virtually eliminate the possibility of a poor image.

A further improvement in techniques was disclosed in a paper presented by Dr. Hillier in conjunction with E. G. Ramberg. This employs what is described as "dark field illumination" providing a high degree of

contrast through which it may be possible to see fine structures in viruses and molecules which by conventional methods appeal only in outline.

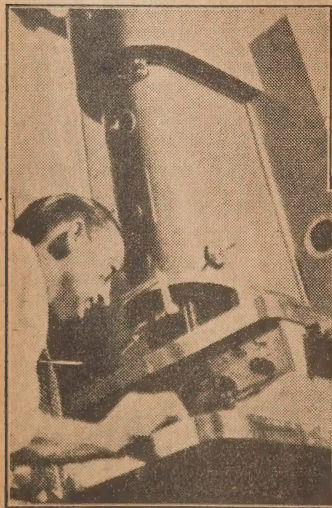
The scientists reported that the dark field images are obtained by using scattered electrons from the image, rather than a direct electron beam which is prevented from reaching the image by the use of diaphragms. It was disclosed that an RCA microanalyser is used in this work to measure with complete accuracy the velocity of electrons leaving the specimen.

TRANSATLANTIC F.M.

INTERFERENCE to British television programmes from American FM broadcasts has become so severe that changes in American programme schedules have been made. Commander E. F. McDonald, president of the Zenith Radio Corporation, asked for and received permission from the FCC to change temporarily the broadcasting hours of his station, WEFM, to avoid interference with the London television station between the hours of 3.0 and 4.0 pm, Greenwich time.

The interference is caused by long-range skip transmissions. McDonald suggested that it is a temporary condition brought about by sunspot activity, now at the highest point ever recorded, and will not recur again as a serious problem at such extreme distances for 11 years, when sunspots will again reach maximum.

Magnifications up to 300,000 times are now possible with the electron microscope (left). Below is shown a micrograph of bacteria as they appear in low contrast when viewed through the conventional lens. On the right, the same area of bacteria as observed by the new experimental double lens.

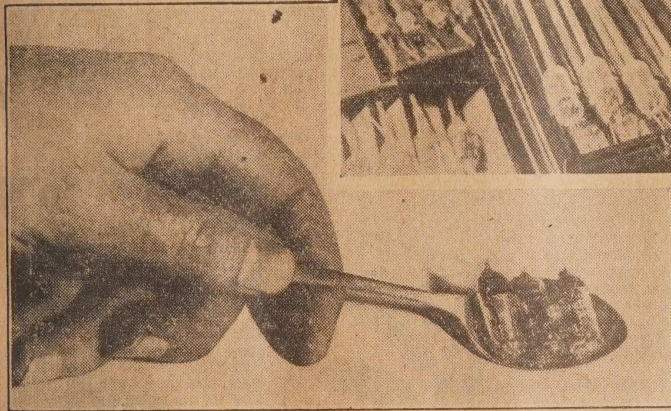


MIDGET VALVES SET NEW ECONOMY STANDARD

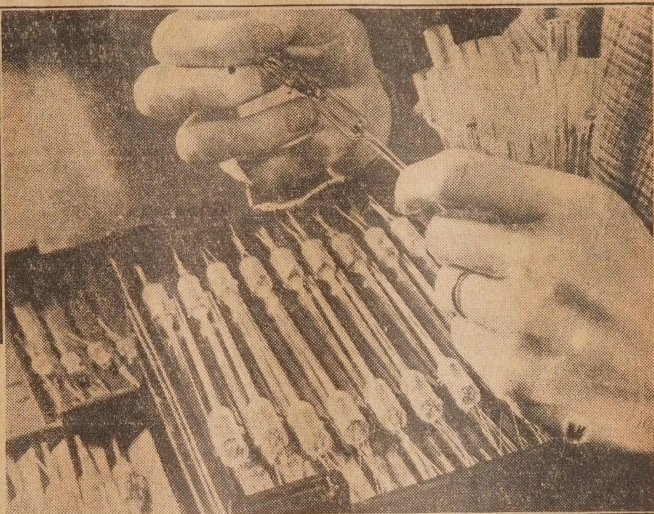
Valves, so small that three of them will fit comfortably in a teaspoon, have been developed by Mullard. They will be used in the State-sponsored "Medresco" hearing aid and an initial order for 400,000 of them has been placed by the British Government. This article gives some idea of their remarkable properties.

MENTION of the hearing aid was made in the last issue. The "Medresco" unit is a wedge-shaped instrument of very small dimensions. The maximum width at the top being $2\frac{1}{2}$ in. and at the bottom $\frac{1}{2}$ in.

The overall length is $3\frac{3}{4}$ in. and it is $\frac{1}{2}$ in. thick. In this confined space is housed an amplifier using two of the new Mullard sub-miniature voltage amplifying pentodes, DF70 and either a DL71 or a DL72 output pentode. These valves are similar in basic design to the American types CK505AX, CK502AX and CK506A, but have the very important advantage of a marked reduction in power consumption.



Three DF70 sub-miniature valves will sit comfortably in a teaspoon. The picture at the upper right shows the electrode assembly being inserted in the glass envelope preparatory to sealing.



DF70 is 30 volts, while the voltage rating for the DL71 and DL72 is 45 volts.

The DL71 output pentode is intended for use with the hearing aid circuit designed to work with a crystal earpiece of the insert type, and delivers a power output of 6 mW. at a distortion level of not more than 10 per cent. An alternative circuit is available for use with an external magnetic-type earpiece. This incorporates the higher-powered output pentode DL72.

Commander Malleon, of the Mullard Wireless Service Company, says:—

"The development of special sub-miniature valves for use in the new hearing aid requires particular emphasis. This development represents a marked advance in British valve manufacturing technique, and enables Mullard to enter a world market previously dominated by American valve manufacturers. There appears to be every hope that this achievement in sub-miniature valves will open up possibilities in all kinds of electronic design applications where size is the limiting factor.

Reference to the accompanying chart will show that the filament current ratings of the Mullard sub-miniatures are extremely low. This advance will be apparent when it is considered that the three-stage amplifier in the hearing aid consumes a total filament current of only 50 mA, as compared with 70 mA for a similar circuit employing American sub-miniatures. This represents over a 30 per cent saving in current.

Taking into consideration the high performance, the anode current ratings are also extremely low. The nominal anode voltage rating for the

The valves are 10mm. (25th in.) in diameter, the lengths being 30mm. (1-1/5th in.) for the DF70 and 38mm. (1-1/2 in.) for the DL71 and DL72 output pentodes. The extremely small size of these valves can be gauged from the fact that three DF70 voltage amplifying pentodes placed end to end, approximate to the length of a Player's cigarette. The electrode structure is built up on a flat glass disc in a manner basically similar to that employed in the well-known all-glass technique. This method of construction ensures a high degree of rigidity and consequent freedom from microphony. The lead-out wires are tinned to facilitate soldered connection into the circuit.

PRINCIPAL CHARACTERISTICS

Type	Vf	If	Va	Vg2	Vg1	Ia	Ig2	Gm	W
		(mA)				(mA)	(mA)	(mA/V)	
Mullard DF70	0.625	25	30	30	0	0.375	0.125	0.175	—
Mullard DL71	1.25	25	45	45	-1.25	0.6	0.15	0.55	6mW.
Mullard DL72	1.25	25	45	45	-4.5	1.25	0.14	0.5	23mW.

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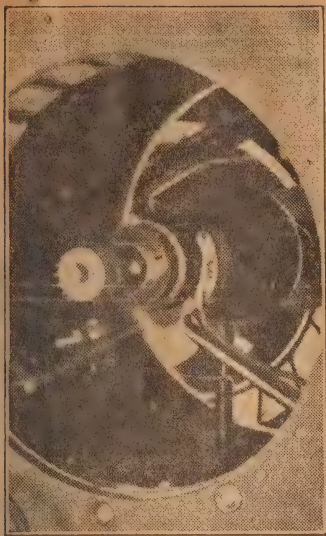
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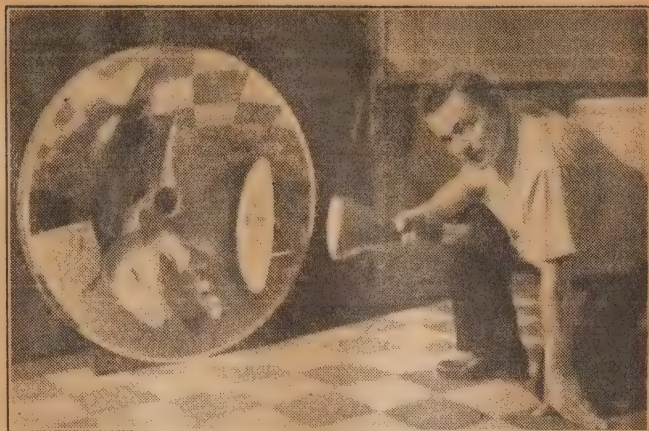
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A peep into the projector front, showing the tube in place in front of the mirror.



The high intensity cathode ray tube is reflected in the large spherical mirror.

LARGE SCREEN TELEVISION

In a paper presented before the Society of Motion Picture Engineers, RCA engineers revealed that they are now able to project pictures 18 by 24 feet—larger than the average motion picture screen—and with a degree of highlight brightness meeting professional motion picture standards.

RCA's new projector utilises a 15-inch cathode-ray picture tube operating at 80,000 volts, and an optical system employing a 42-inch

spherical mirror and a 36-inch aspherical correcting lens. This is the largest Schmidt-type optical system in actual operation in the world.

PROJECTION 40ft.

The projection distance of the new equipment is 40 feet. Although this is not sufficient to permit mounting of the projector in the theatre's regular projection booth it enables the relatively compact equipment to be

installed in the balcony of some theatres. Ceiling mounts are also possible.

Construction of the 42-inch mirror for the optical system necessitated the development of special machines and new techniques. The 36-inch aspherical correcting lens, used to overcome optical effects from the spherical mirror, is made of glass—an inherently costly process. However, it is expected that eventually these lenses may be molded from plastics as are the smaller correcting lenses for home projection-television receivers.

At present the development of large-screen television is a race for ultimate perfection in a mass-entertainment medium that may revolutionise the theatre industry.



The complete large screen television projector is shown above. Some idea of its physical size can be deduced from the picture on the right which shows a tube about to be inserted. The support for the tube is mounted in the door.





by *Calvin
Walters*

understand this remarkable science.

We will take the human body as our example, for to most people their bodies are the most important thing aside from the amount of money they own.

The body is built up of an orderly arrangement of a vast number of microscopical units which we call cells. The living matter inside the cells is called protoplasm whether the cell be animal or plant.

Cells are fitted for special functions which control the body, such as brain, muscle, bone, nerves, tendon, &c., but the composition of cells remains fairly constant no matter what the functions. That is, there is in every cell a nucleus, chromosomes, &c. We are getting too far ahead, however, so let us return.

All the activities inside a cell are controlled by a very highly organized body called the nucleus, which is shut off from the remainder of the cell by a membrane. This nucleus is a wonderful piece of apparatus, which contains the secret of all the different forms manifest in life.

Inside the nucleus are bodies called chromosomes. These bodies are continually changing in various ways, but at certain regular periods in the life of a cell they assume certain well defined characteristics. This

It's a matter of **Hormones & Genes**

THE answer to all these questions lies in the tiny cells of which all living matter is composed. Even our tastes, the way we walk, our manner of speech and our very characters are governed, it seems, by the manner in which the cells of our bodies are built up.

Certain diseases are handed down from parents to offspring both in the animal and plant kingdoms. The disposition to contract certain complaints is also often passed on.

The study of the behavior of the cell is called genetics, and enormous strides have been made in the past few years. It is a most fascinating study for it has to do with the greatest of all scientific riddles, namely, the origin and development of life.

What makes one man's hair red and another man's black? Why is some skin dark and another white? Why is one flower red and another some other color? What is the reason for a midget, a normal sized individual and a Frankenstein monster?

It has been said that from the point of view of science, plants are merely stationary animals and animals are mobile plants. This is largely true, for the knowledge gained in recent years regarding the behavior of cells shows that, although there are differences between the cells of animals and plants, these are unimportant compared to the remarkable similarities.

The cells of animal and plant life contain a nucleus equipped with chromosomes and genes, but first of all let us examine the nature of a cell in detail. When we do this, we will be in a better position to

is when the cell is about to divide.

It is by the division of the cells that a person grows up from a tiny almost invisible egg to a full blown boxer, business man, politician and so on.

The division of cells takes place in a regular fashion. In the human cell there are 48 of the above mentioned chromosomes within the nucleus. The number of chromosomes varies in different species, but for each species the number of chromosomes in each cell is constant throughout the body, and as I said, the human body cells contain 48 chromosomes in each cell.

In the beginning, life is brought about by the well-known process of reproduction. During this process two cells are brought together, one from the mother and one from the father. In each of these cells there are only 24 chromosomes and thus the complete fused cell contains 48 chromosomes which remain constant throughout the subsequent life of the cell.

Normally the chromosomes in a cell are not always visible, and only become so when a cell is about to divide. Their visibility is the first of cell division.

At first appearance chromosomes look like long fine threads, and on closer examination, it is found that these threads are actually two. That is, the thread has split longitudinally so that what appears to be one thread is really two side by side. This splitting of the chromosomes is the first stage of cell division. We must keep in mind that 24 of these chromosomes are from the mother and 24 from the father.

CELL DIVIDES

Slowly, now, these shorten and grow thicker, and the membrane around the nucleus disappears, so that the chromosomes lie freely in the contents of the cell.

The chromosomes now take up a position in the centre of the cell, and the two parts of each separate from each other and move in opposite directions, to collect in groups, each group containing one half of each original chromosome. The new membrane forms around each group, and the cell divides between them. The chromosomes fade into invisibility, and we now have two cells, with a nucleus in each, exactly similar to the original cell from which they were formed. That is, there are 48 chromosomes in each nucleus, 24 from the mother and 24 from the father.

It is, indeed, a most wonderful and fascinating sight, and a simpler and better method of perpetuation could not be imagined.

BANANA FLY

The mathematical facts of the division process are staggering, for each cell gives rise to two, which, on division become four, eight, 16, 32, and so on, to billions.

Now, the chromosomes of the cell contain further bodies, called genes, and it is in these that the very characteristics of the being are located. Indeed, the genes contain the clue to the riddle of life.

The study of the genes has been made possible by the remarkable discovery that the salivary glands of the banana fly, "*Drosophila*," contain cells which have chromosomes some 100 to 170 times as large as those found in other tissues. Thus the chromosomes under the microscope look like threads with alternate bands of light and dark. It is with these bands that the genes are associated.

This fact, coupled with the fact that the banana fly produces one generation in only 12 days, with

HOW A BODY CELL DIVIDES



Diagram of successive stages in the division of the chromosomes and of the cell (mitosis). Only three chromosomes are represented. In A the three have split lengthwise; B, C, D, show successive stages in the separation of the halves into the two new cells produced.

hundreds of young, making two years of the banana fly, equal to 2000 "man-years," allows it to be an amazing object of study.

The result of this study has been the remarkable and almost unbelievable ability of scientists to identify the genes which govern certain peculiarities of the living being.

With certain plants it is now possible for a scientist to point out on a

chart the exact position in a chromosome (which contain the genes) that causes the plant to have red flowers or rough bark or serrated leaves and so on. Similarly, more than 500 genes have been located and identified in the banana fly, so that scientists know the location of the genes which have to do with the size of the wings, color of the eyes and so on.



The fruit fly or banana fly on which much of the study of human heredity is based. The female fly is shown on the left, male on the right.

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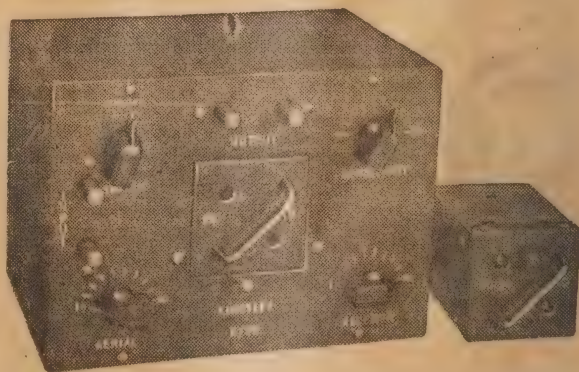
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It has been known since 1927 that, if an individual is bombarded with X-rays or neutrons, a variety of mutations (changes from the normal), is likely to take place.

There is also a drug called Colchicine, obtained from the Autumn Crocus, which causes remarkable things to happen to plants treated with it.

The facts of changes caused by the bombardment by neutrons has had quite a lot of publicity in connection with the atomic bomb. Scientists are anxiously awaiting the new generations of Japanese from the victims of the Hiroshima bombing. It is assumed that the radiations from the bomb will cause mutations to appear, although it is not known what form they may take.

It is possible, of course, that mutations will appear in all forms of life which survived the bombing—animal, insect, bird and plant.

BETTER OR WORSE?

Assumptions that these mutations may take the form of something of a hideous nature are groundless, although it is possible of course, that some of them may be. Perhaps, some of the Japanese may even turn out to be a mutation with a higher form of intelligence and culture than ourselves, in which case they could turn out better atomic bombs with which to wipe out their fellow-man.

The functions of the genes are one of the most remarkable in all nature. It seems that every characteristic inherited by the individual animal and plant alike is stored into these microscopic particles. The whole organism of a living thing is planned by them and no doubt this is done by the combined activities of the genes and the mysterious glands of secretion which pour hormones into the system.

The genes, and the glands and tissues which are built up with their assistance, work to a strict time schedule, which is planned in advance.

Certain characteristics inherited by the individual do not become manifest until a lapse of many years.

DELAYED EFFECTS

Some of the genes are "baddies." These lurk in the system for many years and then suddenly cause a person to become blind or insane or bald, just like some other member of the family, and at about the same time of life.

Other genes control our length of life, which is also determined in advance before we are born. If we are not "popped off" by somebody or something else over which the genes have no control we will live to the age determined by the genes before we were born, for it is now certain, that "longevity" runs in families. It is inherited, and if it is inherited it must be controlled by the genes.

Identical twins are a good illustration of this peculiarity of the genes of running to a strict time table. Twins are produced by some unex-

SCIENCE NOTES—Prof. A. M. LOW

Many people talk of reaction, but they mean, as a rule, that they are tired after the strain of work. Reaction has a technical meaning, too. It is equal to action, as one of the first laws of mechanics tells every student. For example: If I push you against a wall, my feet or body push equally hard in the opposite direction.

A BULLET flies from a gun but the gun jumps too; being heavier it jumps less far.

My car has just been rebored and every time I cautiously accelerate in neutral the car shivers because it is trying to turn round the engine just as much as the engine is turning round in the car.

Relative speeds offer some comparable problems. Bullets fired from trains at the engine-driver can hit him because their total speed is that of the bullet plus the train, relative to the earth. Fired from the track, they merely run beside the driver if the speed of bullet and train are (most improbably) equal.

When you step on to a moving platform or stairway, walk quickly so that your body and the track travel together. If you walk at the rate of the moving platform and stand still when reaching it, there will be no shock. This avoids all chance of "after-dinner" accusations!

SECRETS

I CAN scarcely remember one occasion when I have ever approved of secrecy. In the first place it is nearly impossible; and secrets nearly always do harm in the end.

That is one reason why science is not very popular. Until quite recently science was rather frowned upon in England, and was looked upon to some extent as the prerogative of poor people while the wealthy devoted their time to the glories of Plato, Socrates and Louis XIV. Or were supposed to do so.

All this brushes aside the brutal truth that unless dead languages and old thoughts can be reborn as something new, or original they are next door to worthless. The medical profession have been sinners in this respect. Everyone knows that many diseases have grown due to the secrecy surrounding their onset. I understand that both cancer and TB can often be cured or rendered innocuous when taken in time. These things are not matters for whisperings.

Nor do I like the extensive use of Latin, or rather Dog Latin, terminology for I think it gives the partly educated an unfair advantage over those who are too easily impressed.

PATENT MEDICINES

LOOK at the number of patent medicines which are sneered at because they are patents, although this trouble has now been remedied in most cases by the new Patent Laws which do not permit a combination of a few chemicals to result in worthwhile protection! One hears

people say, "How absurd to charge 5/- when the materials are worth a farthing." "Not at all," I reply; "they are well combined, conveniently manufactured, and they do their job."

So let us sweep away this idea that science belongs only to a few queer men with big black hats and bushy hair. The housewife using soda for cooking, or bicarbonate of soda in bread, may be making a complicated experiment. As well treat this a secret as the atom-bomb. In short, it is impossible to keep it dark.

HOME CHEMISTRY

I F I mix a little acid and a little bicarbonate of soda into a pudding, carbon dioxide is evolved. Just the same gas that so many fire extinguishers produce. A gas, which is inert, can be used for preserving apples, and which comes out of our lungs every time we breathe. The chemical actions which can be expressed in complicated symbols really need no glorification.

If hydrochloric acid is used with chalk as a "riser" the pudding would rise most excellently. Some of the carbon combines with some of the oxygen to produce carbon dioxide, some of the calcium in the chalk combines with some of the chlorine in the hydrochloric acid and a little water in various stages of composition is also released. The real point is that chlorine, a deadly poison, is quite harmless when combined with something it clings on to out of the chalk.

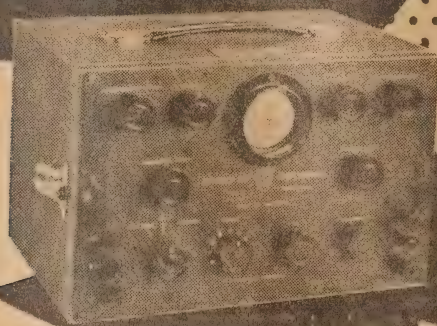
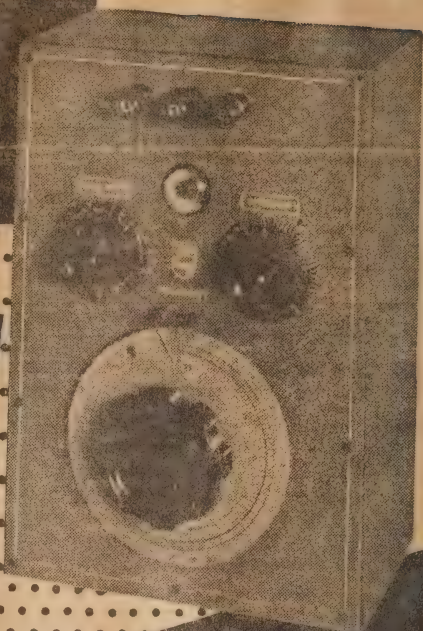
There are many similar examples. Think of the hydrogen from the gas jet which combines with some of the oxygen in the air, boils your kettle, forms steam in doing so long before the kettle boils, and then probably condenses on the bottom of the kettle before the rate of heat transfer becomes great enough to turn the water drops outside the kettle into steam. All very scientific indeed.

Ancient measurements were anything but accurate. A foot was the length of a man's foot and the thumb was an inch. A cubit was the length from the elbow to the top of the middle finger, and a yard the distance from the tip of the nose to the end of the middle finger when the arm was outstretched.

Frogs and toads are represented by about 900 species. Before a tadpole becomes a frog it goes through a long fast, during which the body is nourished by the gradual absorption of the tail.

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VALE—GOODBYE TO THE SPITFIRE

THE story of the Spitfire has, in a few short years, become one of the world's great real-life romances. The drama of its background, the urgency of the need, the war-winning success of the achievement—these are the ingredients of a legend, and generations after this last "Spit" has been broken up in its scrapheap, the tale of Mitchell and the Spitfire will be retold.

Those of you who saw the film "First of the Few" know the rough outlines of the story. It goes back to the Schneider Trophy when the then small aircraft works of "Supermarines" produced a world record float seaplane, the S.6.B.—descendant of the winning Supermarine S5 and S6 of 1927 and 1929. It was built as a private venture with money provided by Lady Houston so that Britain could defend the Trophy at a time when the Government, then in the throes of an economy campaign, was unwilling to finance a new racing plane out of public funds. The S.6.B. was, like the 1927 and 1929 winners, designed by R. J. Mitchell—already a sick man with rest and retreat his only hopes of recovery.

But Mitchell, perhaps with premonition of the conflict to come, refused to rest. He worked day and night on his new machine, and, together with the Rolls-Royce engineers who were then developing their famous "R" engine, he managed to finish the S.6.B. at Calshot in time.

It won the race at 340.08 mph, and later set up a world record at 407.5 mph.

MUSEUM PIECE

Today the Schneider Trophy, won outright by Britain, with three successive "Mitchell/Rolls" victories, stands in the ante-room of the Royal Aero Club, while the S.6.B. herself hangs in the South Kensington Science Museum where not one in a hundred of the people who see her realise what a part she has really played in the history of the world.

For Mitchell, the main point of the Trophy aircraft was not the glory they won, but how they could improve the breed of squadron-service fighters which were the air defence of Britain.

He set to work to incorporate the lessons of the Trophy race designs into a revolutionary military land aircraft, and in 1934 he had built a specimen machine. He called it the "Spitfire," and it was a low-wing fixed undercarriage monoplane with a 600 hp Rolls "Goshawk" motor. Only the prototype, however, was built, and the name "Spitfire" was then transferred to a follow-up aircraft, built merely as a private venture. By now Mitchell knew beyond doubt that he was a dying man,



The last of the Spitfires—Mark 24.

The last of the Spitfires is being built. It is No. 21,767—a Spitfire Mark 24, the last and final form of the world's greatest war-plane; the machine which fought in 33 different roles, and on every battle-front from September 1939 to August 1945, and was still the best of the bunch at the end.

and he was also convinced that war with Germany was not far off. He had seen the new German Air Force and he was frightened for England.

In the last packed years of his life, Mitchell burned himself out to get the Spitfire design completed and accepted by the RAF, and into the slender body of this great fighter went all his genius. Urged on by two overriding fears—that he would die before the Spitfire flew, and that war would come before the Spitfire was in service production—Mitchell worked 14, 16 and 18 hours a day.

MITCHELL'S TRIUMPH

In March, 1936, the prototype, the F37/34, took off from Southampton. The RAF came down to see it fly, and from that moment the "Spit" was "sold" to the service. Mitchell had won his first and important battle—which was to get the aircraft recognised and accepted. For another year he devoted himself to perfecting the detail and arranging large-scale production. But, as the first precious production-line models were nearly ready for flight test, Mitchell died, and Mr. Joseph Smith, now Supermarine's chief designer, took over.

That was in 1937; today, in 1948, when there have been 24 different "marks" or variants of that first

"Spit I," the basic design of the Spitfire remains almost exactly as Mitchell drew it in 1935. Through six years of war, his work stood the test. From first to last it was a great aircraft, and only the advent of the jet engine is finally taking it out of the front-line.

That first Spitfire I, with its fixed pitch wooden airscrew, had a top speed of 342 mph, which made it the world's fastest fighter. It could climb at 2500 feet a minute and its armament was eight machine-guns.

The final "Spit" has a top speed of 450 mph; a climb of 4900 feet a minute, and its armament is four 20-mm cannon and rocket projectiles. Rolls-Royce, who developed the "Merlin" from the 1929 Schneider Trophy "R" sprint motor, have provided the Spitfire engine throughout. The first Merlin in the first Spit had a bare 1000 horse-power; the RR Griffon in the Mark 24 has 2000 horse-power—yet the airframe, brilliantly adapted and modified by Joe Smith, has always retained the original beauty of line.

Not long ago the august Royal Aeronautical Society of Great Britain presented an award to Smith for his work in developing the aircraft through 23 different marks, and through a speed range of 100 miles an hour, while yet retaining all its original characteristics of climb, manoeuvrability and gentleness.

"ACHTUNG-SCHPITFEUR"

The urgency with which Mitchell had always regarded the project was not, as we now well know, exaggerated by events. Although the

(Continued on Page 81)

by Charles
Gardner



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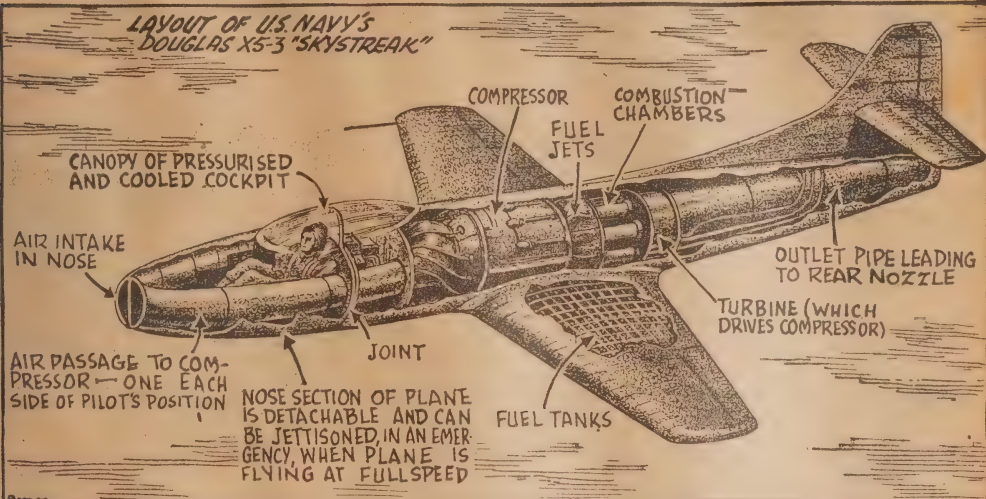
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JET PLANE HOLDS SPEED RECORD

LAYOUT OF U.S. NAVY'S
DOUGLAS X5-3 "SKYSTREAK"



Jet propulsion has enormously extended the actual and potential speed of aircraft and, quite apart from its technical aspects as a propulsion unit, the turbo-jet is having a considerable effect on aircraft layout. Although external features such as fuselage, wings and tail remain almost unaltered, many changes result internally from the use of the turbo-jet instead of the conventional motor and propeller.

IN the case of the single-seat machine, the changes are exemplified by the Douglas X5-3 Skystreak, which reached an air speed of 650.6 miles an hour in creating the world's speed record.

As can be seen from the diagram-sketch, the pilot sits well forward in the nose section. Because of the extremely high speed reached, a new method of escape in an emergency had to be devised, and the nose section has been made detachable.

The air intake in the extreme nose is split into two streams, one of which is ducted along each side of the pilot. They merge again to enter the intake chamber of the compressor, in which an impeller raises the pressure of the air as it is forced back to the combustion chambers.

FUEL INJECTED

Here the air is mixed with fuel oil, pumped in under pressure. In burning, the fuel gases expand rapidly. The lateral pressures, acting on the sides of the combustion chamber, cancel each other out. The only way out for the gas is through the exhaust to the rear nozzle. As the gas escapes from the chamber, pressure at the opposite point forces the plane chamber, they act upon a turbine forward.

As the gases leave the combustion

which is linked to the impeller that drives the air under pressure into the combustion chamber.

While it is true that the fuel consumption of the gas turbine is at present two or three times that of a piston engine of similar power at normal speeds and altitude, the installed weight of a gas turbine is only half that of a piston engine of equal power.

Another great advantage is that the propulsive force of a jet can be applied directly, without the use of any device such as a propeller.

HIGHER SPEEDS

In the few years during which jet propulsion has been a reality, "jets" have lifted the air speed record to new levels.

Where larger aircraft (bombers) are to be powered by jets, the gas-turbines are mounted, singly or in tandem or side-by-side, within specially designed nacelles slung beneath the wings.

Experts have predicted that commercial flight by "jets" will be possible in 10 years or less. It is said that when the cost and development of jet propulsion have reached a level that makes it practical for commercial use, jet-powered airliners will appear on the world's air lanes.

Among disadvantages of jets in their present state or development are lack of reliability, brevity of ser-

vice life, limited take-off power, shortness of range, high fuel consumption, complicated fuel system, and the necessity for large still-to-be-developed accessory units.

Advantages visualised are: Greater speed with full control; better climb; and the use of cheaper, non-explosive fuel such as diesel and tar oils.

EFFICIENCY v. SPEED

Comparisons between the relative effective efficiency of the piston type aero engine and the jet engine show that at 20,000 feet the piston engine and propeller reach the peak of efficiency around the 300 mph mark. From that point, efficiency falls until, at almost 540 mph, the piston engine is surpassed by the jet engine.

The upper limits of jet speeds are already being reached as jet propulsion launches aerodynamics forward into the velocities that have hitherto been the realm of ballistics. The barrier to this realm is the speed of sound. Shock waves generated at this speed vastly increase air resistance and drag and set up vibration and "flutter."

At 800 mph it is thought the possibility of efficient ram compression will introduce the "athodyd," the simplest jet engine yet devised. The athodyd (Aero Thermo-Dynamic Duct) has no moving parts, being simply a nozzle-shaped pipe inside which are a fuel injector and a spark plug.

To operate, the athodyd must already be moving forward at great speed, with air rushing through it. Just within the athodyd's mouth the inrushing air slows down momentarily. The air is simultaneously com-

(Continued on Page 75)

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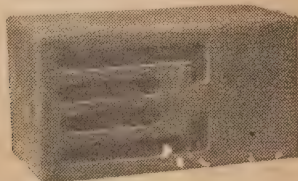
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English 3 GANG CONDENSERS

These condensers are complete with trimmers. Size $3\frac{1}{2}$ in.

x $2\frac{3}{4}$ in. x 1 5-8 in. **19/11**

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NEWS AND VIEWS OF THE MONTH

High-class Sound

DURING the past few weeks we have listened to several independent demonstrations of sound reproduction, using the very latest equipment. The immediate purpose, in most cases, was to demonstrate the ability of this equipment to handle all frequencies up to and beyond the limit of audibility. While this purpose was achieved, we have registered two or three other impressions which have a vital bearing on the subject.

In the first place, we cannot help but feel that the conventional shellac pressing, as we know it, must be radically improved. The new wide-range pressings certainly carry a range of frequencies well in excess of that recorded a few years ago, but our experience of the discs to date indicates that the quality is very patchy. There is a variation from one disc to the next and even between the sections of a single disc. The noise level on some is very low but, on others, the extended frequency range is accompanied by an unhappy background of hiss and crackles. The reaction of many listeners, who are impressed by the result rather than by technicalities, is a preference for older records, and for equipment less ambitious but less trying on the nerves.

On the other hand, we have heard discs of vinylite or with special surface materials which were a revelation in quality and in the complete

absence of background noise. There may be serious problems about scrapping the traditional abrasive-shellac pressing, but it must come in this current search for better quality.

Stereoscopic

ANOTHER point is that a closer approach to the ideal in terms of distortion and frequency response, serves to emphasise the "hole in the wall" effect of a single loud-speaker. In fact, to our mind, the lack of reality due to this effect, in a recent studio demonstration, very largely offset the otherwise flawless reproduction. It seems that the trend to high fidelity demands some "breadth" in the sound source, even if it is obtained simply by suitable isolation of the high and low frequency loud-speakers.

Last but not least there is the psychological factor. Music which invades the home in its full natural

timbre has a character and individuality which demands alertness and the full attention of the listener. If music is to form a background to conversation or reading it must be "woolly" and dull so as not to intrude into the other activity. Under the same circumstances high fidelity is likely to be more annoying than pleasant.

A goodly percentage of listeners do treat their radio as a background and it may be this factor which causes them to reach for the tone control, rather than the classical story of harmonic distortion.

U.S. Television

ACCORDING to reports from the United States, television sales in that country have suddenly begun to boom. This may well be the initial move in the establishment of television on a really large scale.

Television has been technically possible for years but, in America

RADIO CROSSWORD PUZZLE No. 8

ACROSS

1. Grown up.
4. Smallest particle.
8. For measuring electrostatic charges (two words).
10. Inserted in pickups.
11. Sped.
12. Inductance.
14. Shrub.
17. Type of code.
18. Condensers.
21. Parallel resistor (two words).
22. Porch.
23. Indicator.

DOWN

2. Communication channel (two words).
3. Nearby station.
4. Type of cable.
5. Point near a lens where rays are unchanged (two words).
6. Television term.
7. Valve elements.
9. Try out.
13. Self inductance is electrical ...
15. Accumulate.
16. Alcove.
19. Needed for amplifiers.
20. Certain.

BELOW: LAST MONTH'S SOLUTION

C	O	N	V	E	R	T	E	R	T	S
H			A			B	E	A	T	
O	S	C	I	L	L	A	T	E	S	A
K	O		C	A	P	A	C	I	T	O
E	A	R	S		I	N	O		C	
	M	E	T	E	R	K	I	N	E	T
P	A									O
T	E	S	T	E	D	D	A	Z	E	D
R	I	I				U	E	V	E	N
R	E	A	C	T	A	N	C	E		I
I	T		P	L	U	T	O	C	R	A
N	E	Q	N		L					E
G	M		V	O	L	T	M	E	T	E

	1	2		3			4		5	
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8						9				
10								11		
			12		13		14			
15							16			
17							18		19	20
21										
	22							23		

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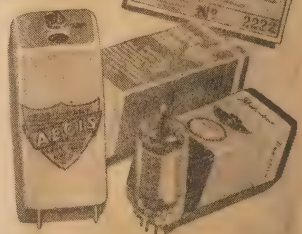


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(PP4) for broadcast band.

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Phillips Electrical Industries
of Aust. Pty. Ltd.
Australian General Electric
Pty. Ltd.

Cook Bros. Pty. Ltd.
ADELAIDE:
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Newton, McLaren Ltd.
A. G. Healing Ltd.
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Oliver J. Nilson & Co. Ltd.
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EXTENSIVE
Chandlers Pty. Ltd.
A. E. Harrold Pty. Ltd.
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PERTH: Nicholson's Ltd.
TASMANIA:
Lawrence & Hanson Elec-
trical Pty. Ltd. (Hobart).
Lawrence & Hanson Elec-
trical Pty. Ltd. (Launceston).
Replacement Parts Pty. Ltd.

at least, has been in a commercial stalemate. There have been few sponsors willing to sink money into programmes for just a handful of viewers. And, conversely, the programmes were too limited to attract many set buyers.

Now, apparently, in typical style, there has been a sudden upward trend of television set sales. The effect looks like snowballing, and already there is an evident shortage of technical men with sufficient knowledge to produce, maintain and service the increased number of television sets. The bubble may burst, of course, but the general impression in television circles appears to be "This is it."

Amateur Bands

RECENT issues of overseas amateur magazines have featured prominently the principle of single-side-band suppressed-carrier transmission—S.S.S.C. to you!

It has long been known that both side bands are unnecessary to convey intelligence, so that the suppression of one of them materially reduces the ether space required by a given signal. The further step is to suppress the carrier also, so that only one side band is radiated.

Immediate advantage of this is that transmissions on adjacent frequencies do not produce the beat notes so familiar to all operators on the amateur bands. Signals may still interfere but it is easier to separate the required intelligence when there is no "organ pipe" background. As one writer aptly puts it, it is not difficult in a crowded foyer to follow a given conversation, even though other conversations are going on all around. But imagine the effect, says the writer, if numerous patrons were simultaneously blowing a penny whistle!

At the transmission end S.S.S.C. operation requires a new technique but can be accomplished with less expensive apparatus. The transmissions can be received on ordinary communication sets provided they are equipped with a stable B.F.O. For optimum results, however, a specially-equipped receiver is desirable.

From the technical and practical point of view there can be no doubts about the advantages of S.S.S.C. transmission on the amateur bands and some will take it up purely as a matter of technical interest. However, unless it is accepted on a fairly wide scale the pioneers will remain pioneers for a long time to come and their signals unheeded chirps in the general confusion.

Local amateurs are naturally interested in the idea, but the position in regard to licences is not clear. S.S.S.C. transmission is an extension of amplitude modulation, but the ultimate signal is rather outside the accepted definition of "A3" transmission. The authorities should clarify the position so that experiments can be carried out locally without fear of crossing the law.



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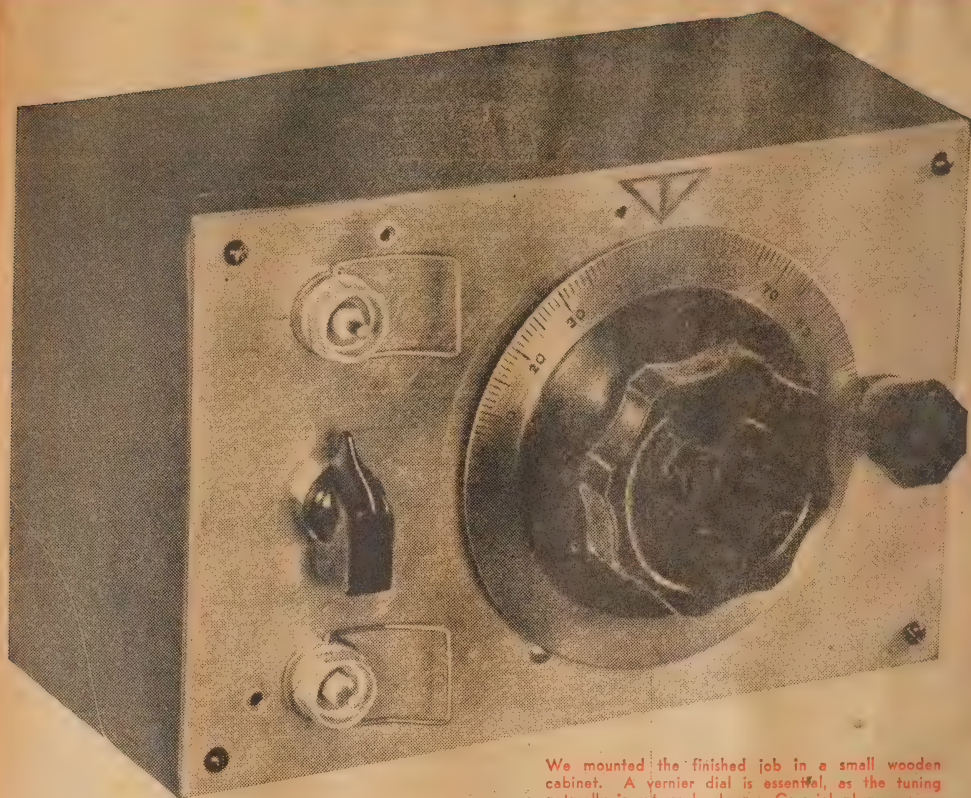
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We mounted the finished job in a small wooden cabinet. A vernier dial is essential, as the tuning naturally is extremely sharp. Co-axial plugs are ex-disposals, and may be replaced by terminals if 300 ohm line is used.

A SIMPLE 144 MC. CONVERTER

The change over from "166" to "144" megacycles for amateur use will undoubtedly bring more activity on the air. Many have been waiting for this change to get their equipment in action. Here is a simple converter of standard design which will enable you to hear 144-megacycle transmissions.

MUCH of the equipment which has been used on the now extinct 166 Mc. band, was of the modulated oscillator cum super-regenerative type, but there are evident signs that the transfer to 144 Mc. will see wider use of crystal controlled equipment.

With this in mind, we decided that our first simple receiver for this band would be in the nature of a converter, rather than one involving a super-regenerative detector. The converter is likely to be cheaper, more stable in operation, and certainly not given to radiation effects.

by *Raymond Howe*

It can be assumed that all amateurs have a suitable receiver to follow the converter, as well as supplying the small amount of heater and high tension drain.

Having decided in favor of the converter, we can proceed to discuss some of the relevant design factors.

The question of the IF channel is a point upon which the constructor may make his own choice. It is not advisable to select a channel as low as 2 to 3 Mc, as it is likely to accentuate possible trouble with "image" reception, and oscillator "pulling."

There is a standard IF channel of 10.7 Mc. for which IF transformers are obtainable, when amplification at this frequency is necessary other than by using an existing re-

ceiver. However, not all amateur receivers tune to this frequency, and a channel of 13 Mc. was selected and used instead, in this converter.

This frequency is sufficiently close to the 14 Mc. band as to be covered by practically all receivers, and yet the circuit is capable of being tuned to 10.7 Mc. if desired. Actually, with the data given, there is sufficient coverage to tune beyond the 14 Mc. band.

The mixer and oscillator functions may be performed by a twin valve, as we suggest, or by entirely separate mixer and oscillator valves. In the latter case, oscillator injection voltage may be adjusted from a minimum to an optimum value by the adjustment of the injection coupling capacitance. There is an advantage in that a compromise may be reached between oscillator "pulling" and satisfactory mixer conversion gain.

If the separate oscillator is a pentode, "pulling" is much reduced by using an electron-coupled oscillator and taking the injection voltage from the plate.

VALVE TYPES

At this point one could launch into a lengthy discussion of valve types, and their possible value at 144 Mc. But it is sufficient to say that, for frequencies above 100 Mc., small physical size is of vital importance, both on account of inter-electrode capacitance and loading effects on the associated circuits. Valves in the "acorn" and "900"-series come into their own at these frequencies, and more modern types like the 6AK5 and 6AC5.

However, with simplicity in mind, the rather obvious choice for our purposes is the miniature twin triode type 6J6.

The characteristics reveal excellent figures for transconductance and equivalent noise, it is readily available, it offers extreme constructional simplicity with the two sets of elements in the one envelope.

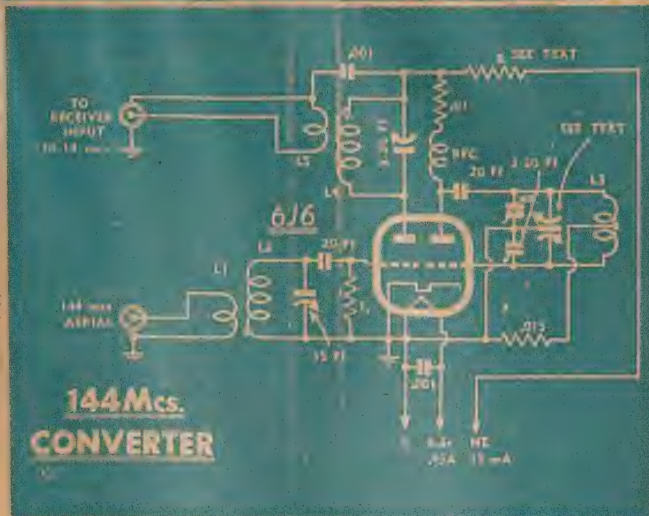
Having made this choice, the type of oscillator circuit to use with one triode section is the next consideration. The use of a feedback winding is mechanically awkward, while variation of inductance in the preliminary stages of adjustment often requires simultaneous readjustment of feedback coupling.

FEEDBACK CIRCUITS

The obvious idea, then, is to use a tapped coil. With the Hartley circuit, the feedback adjustment is by movement of the coil tap, which at these frequencies, would be to a fraction of a turn.

You will see from the circuit that a Colpitts type of oscillator is used, for two main reasons. The "butterfly" type of tuning condenser is ideal for this oscillator, though by no means the only choice. Its advantages are, however, that there are no wiping contacts to act as a possible source of noise and the single hole mounting may be made direct on to the chassis or, in this case, the front panel. Being a "balanced"

CIRCUIT OF THE 144 MC CONVERTER



The circuit diagram shows the hook-up to be quite simple. Details of the butterfly condenser are given in the text.

type of condenser, it suits the symmetrical arrangement of the Colpitts circuit.

In the interests of oscillator stability, a high C/L ratio was arranged for the tuned circuit by placing across the "butterfly" condenser two 3 to 30 pf. trimming condensers in series, the junction being connected to earth. In addition to providing the desired high C/L ratio, these condensers permit simple adjustment of the oscillator feedback voltage.

A further point of interest in this portion of the circuit is that the grid

condenser is placed between the plate and the plate end of the tuned circuit. This still allows the oscillator to provide its own bias, but removes d-c from the tuned circuit. The values of grid condenser and grid resistor were chosen to minimize risk of the oscillator "squegging" when operated with the suggested plate voltage.

The amplitude of oscillation with a plate voltage of approximately 60 volts was adequate. However, a voltage of 100 is indicated at the "cold" end of the IF transformer, being the usual figure for that section of the 6J6 serving as a mixer. The resistor in the plate circuit of the oscillator serves the twofold purpose of providing the voltage drop and increasing the effectiveness of the RF choke.

The other resistor marked "R" and the associated .001 mfd. condenser decouples the whole converter from the H.T. line of the receiver. "R" should be adjusted to drop the usual 200-300 volts of the receiver H.T. to the required 100 volts for the converter.

MIXER CIRCUIT

The first section of the 6J6 operates as a grid-leak biased mixer. This arrangement has proven its worth on other bands, and is the most suitable in this case. Cathode-biasing with a common cathode lead would inevitably increase the coupling between the two sections over and above that already provided by the inherent capacitance between sections.

As the coil in the mixer grid circuit is soldered into place permanently, a reasonable circuit Q may be

PARTS LIST

Front panel 7 1/2 in. by 5 1/2 in.
Cabinet 7 1/2 in. by 5 1/2 in. by 3 1/2 in. (outside dimen.).

- 1 "Butterfly" type variable condenser (see text). 1 dial to suit.
- 1 15 mmfd. midget variable.
- 3 3-30 mmfd. trimmers.
- 2 coaxial sockets (panel mounting).
- 1 button-base valve socket.
- 1 valve type 6J6.
- 1 pointer knob.

CONDENSERS

- 2 .001 mfd. mica. 2 20 pf.
- 1 1 meg., 1 0.15 meg., 1 .01 meg., R (see text).

SUNDRIES

- Insulation and potentiometer shaft and bearing for the "butterfly" condenser, scrap aluminum for valve bracket, short length 16 SWG tin plate for valve shield, resistor strip, hook-up wire, solder lugs, nuts and bolts, &c.

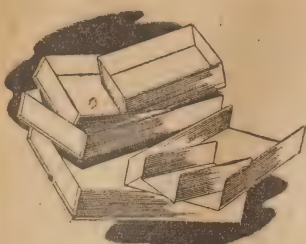
COILS

- L1 1 turn 3/16 in. dia. 18 or 20 SWG spaghetti covered.
- L2 3 turns 3/16 in. dia. 16 SWG spaced to 3/16 in.
- L3 2 turns 1/16 in. dia. 16 SWG spaced to 1/16 in. with 1/16 in. connecting length.
- L4 25 turns 30 or 32 SWG closewound on 1/16 in. former.
- L5 5 turns 30 or 32 SWG closewound and tightly coupled to L4.
- RFC 15 turns 1/16 in. dia. approx. 26 SWG.

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"Q Plus" Recessed Knobs. Walnut, Red,
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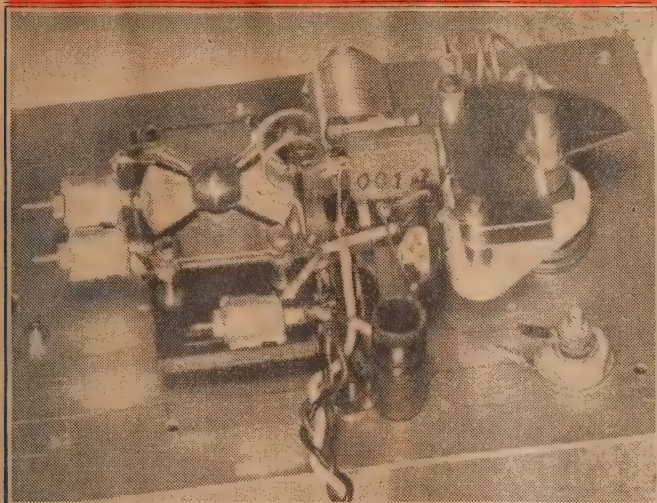
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REAR VIEW OF THE CONVERTER



This picture shows the back of panel. All the major components are easily recognisable. The tube "can," not always needed, was improvised by a winding of tinned wire with supporting wires soldered along its length. The output coupling coil is in foreground.

obtained. With the value of capacitance shown in the diagram, the inductance is adjusted by squeezing or spreading the turns so that, at the high frequency end of the band, the condenser peaks towards the minimum capacitance setting.

The tuning of the output transformer is fairly broad, since the comparatively low plate resistance of the 6J6 imposes a damping effect upon the circuit and reduces its Q. This is not of great importance when the communications receiver has at least one stage of RF amplification ahead of the converter.

The loading on the output transformer by the low plate resistance of the 6J6 may be reduced by employing matching network, which takes the form of two condensers connected in series and placed across the IF transformer primary winding. One of the condensers is made variable and the plate of the 6J6 mixer section is connected to the junction of the two condensers, with an independent d-c feed. The resultant series value of the two condensers tunes the winding, while the ratio of one to the other adjusts the "tapping" of the 6J6 plate on to the winding.

Such an arrangement sharpens the tuning of the IF channel, and gives a slight increase in gain. However, in the interests of simplicity, this refinement was not included in the design.

MOUNTING DETAILS

The complete converter was mounted on to the aluminium front panel which measures 7 5/8-in. by 5 1/8-in. This front panel then fits into a box cabinet 3 1/2 inches deep. The knobs, dial and coaxial sockets are arranged symmetrically with the 14 Mc. aerial input at the lower left-hand corner and the IF channel

output at the upper left-hand corner.

The construction of the "butterfly" condenser is not at all difficult, and in many cases the necessary materials will be on hand. The piece of insulation may be of polystyrene or phenolic material. Good quality bakelite would do, as losses in this portion of the circuit do not affect the strength of the signal, provided sufficient injection voltage is available.

The condenser shaft and its bearing mounting came from a wire-wound potentiometer of prewar manufacture. The fixed plates may be cut from aluminium, brass or similar material, while the moving vane should preferably be of brass or copper. This vane is soldered on to the hexagonal end block which originally carried the moving arm of the potentiometer.

MAKING THE PLATES

It is advisable to "dress" all fixed plates while they are held firmly together in a vice. This will ensure that they are all of the same shape and area. A template for the fixed plates may be made up by drawing on the material to be used an isosceles triangle with a base measurement of 1 1/2 inches and the perpendicular height of 3/4-inch. The apex of the triangle is then cut away to provide adequate clearance for the end block on the shaft to rotate freely in between the two sets of fixed plates.

Holes are drilled in the base corners of these plates for the purpose of mounting on to the insulating material. The distance which these plates will be from the insulating material will be governed by the type of shaft bearing mounting. Two plates in each half are used.

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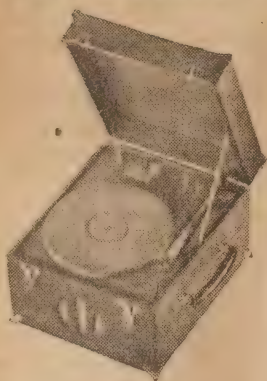
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The general shape of the moving vane can be seen from the photograph. Make sure that both halves of this vane are of the same shape and area. Each half should be of such a shape as to mesh as fully as possible with the fixed plates without fouling the mounting bolts. It may be found necessary to file a flat on the spacing nut in between the fixed plates. Alternatively, the base corners of the fixed plates may be extended so that the mounting bolts are sufficiently removed from the meshing area.

CONDENSER VALUE

The exact capacitance value of this condenser is not important just so long as sufficient tuning range is available. Its tuning range may be adjusted to a certain extent by varying the spacing between the fixed plates.

The 3 to 30 pf trimming condensers shunted across the "butterfly" are of the cylindrical type, mainly because this type was on hand. Conventional air-spaced trimmers would be a little awkward, physically.

The mixer grid circuit is tuned by a 3-plate, comparatively wide-spaced

ACTUAL SIZE



An outline drawing of the condenser plates—actual size.

midjet variable with Steatite insulation. Its maximum capacitance is in the vicinity of 15 pf.

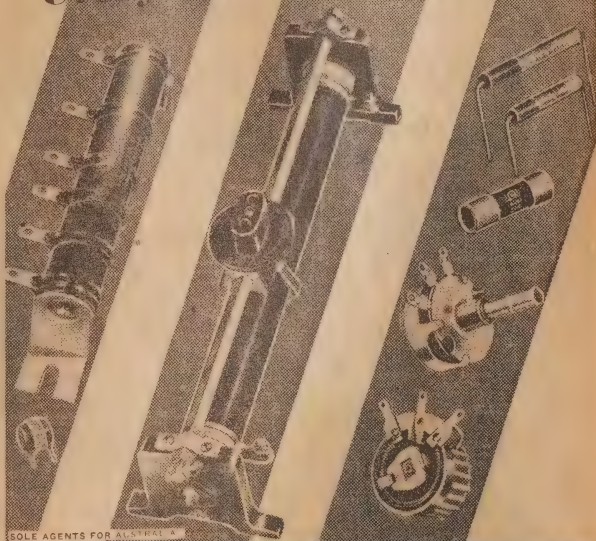
As with the oscillator coil, the mixer coil is mounted direct on to the terminals of the condenser. It is preferable to use wire of reasonably heavy gauge in the interests of stability and circuit Q. In this respect, 16 SWG tinned copper is a handy size which is usually available. The aerial primary may be of a lighter gauge for ease of adjustment. It is a good thing to slip a length of spaggetti covering over this coil. Do not forget to wind the aerial coil in the same direction as the grid coil with the earth end remote from the grid coil. The coils shown in the photograph were those slipped into place to try the converter on the 166mc. band.

VALVE SHIELD

It is just as well to place a shield over the 6J6. The standard item with its associated base was on hand, but the more usual button-base phenol socket was used and a shield manufactured to suit. It could

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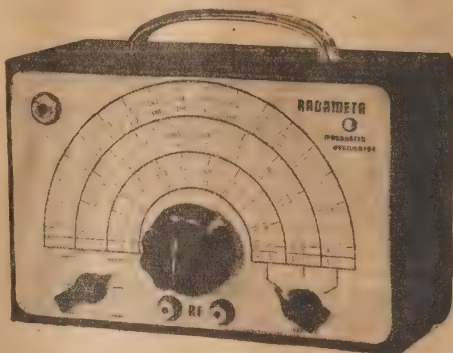
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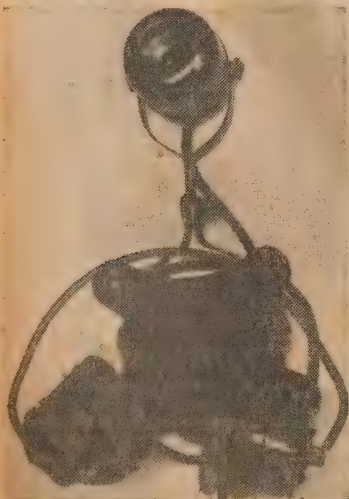
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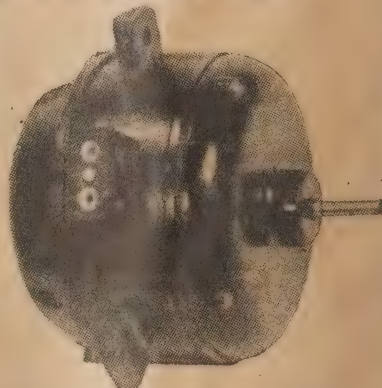
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be of "light gauge tin-plate, but another simple idea is to close-wind a sufficient number of turns of, say, 20-gauge tinned copper wire to take up the length of the valve.

The valve is mounted on a bracket 1 1-8 inches wide, which protrudes from the front panel a distance of 1 3-8 inches.

As the photograph shows, most of the components other than the actual tuned circuits are grouped around the valve socket. It is very important to keep all leads as short as possible. All cathode return leads are connected to one spot, the cathode. The cathode lug and one filament lug were bent on to the metal centre portion of the socket and soldered to it. An earth lug was then bent on to that and soldered in place. The small metal ring holding the socket was used to take the earthing of the valve shield, oscillator grid leak and the earth end of the grid tuned circuit. As the lug soldered to the cathode is held by the same bolt which fastens the socket clamping ring to the bracket, these cathode returns can be considered as having been made direct to the cathode lug.

In selecting the bypass condensers, grid condensers and resistors, favor those types which are very small in physical size and you will be repaid in ease of wiring and generally "fitting" the components into place.

The 6.3 volts for the heater and the HT volts are brought to the unit via suitably-colored leads and attach to anchoring spots provided by a terminal strip. It is well to remember that, if one side of the 6.3 volts in the communications receiver is earthed, it will be necessary to ensure that that side is connected to earth in the converter.

The choice of dial will, in many cases, be a matter of just what the individual constructor has on hand. The disc type with a large centre knob are useful because vernier drive can be easily added by using a small knob with a rubber grommet or rubber ring suitably mounted to friction drive the edge of the disc.

Regarding the bandspread on the dial, remember that the "butterfly" type of condenser goes from maximum to minimum capacitance with just 90 degrees rotation. It is wise to keep the limits of the band within the 90 degrees so as to be able to check for off-frequency operation.

We come now to a discussion of the procedure of setting the finished converter into operation.

The first step is to align the output transformer to the desired IF channel. Any change from the 13 mcs. used in our unit will require slight adjustment to the LC constants for the oscillator.

After coupling the converter to the receiver with a length of coaxial cable, tune the receiver to the frequency of the IF channel and adjust the 3 to 30 mmfd. trimmer across the IF transformer primary winding for greatest noise in the receiver. The adjustment will be fairly broad but definite indication of resonance is there. You will probably notice that the resonance peak is sharper

(Continued on Page 87)

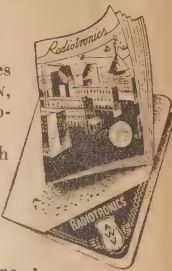
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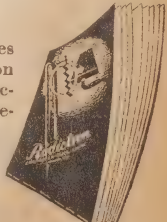
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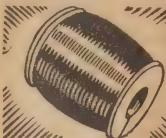
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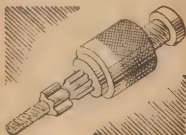
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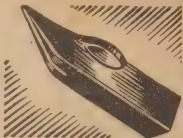
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FROM THE SERVICEMAN WHO TELLS

Perhaps it's the effect of recent holidays but I find myself in a distinctly reminiscent mood. In fact, were I anything of an artist, I could represent it by the vague outlines of a typewriter set against a background of circuits and receivers. Somewhere in the design I would have to work in strokes and "wiggles" representing a variety of experiences which come to mind.

OVER many years of receiver servicing in the home, shop and large service establishments, one comes up against all kinds of people and circumstances which are a source of amusement as one looks back.

But wait! I see in this a germ of an idea involving the readers of this article—both of them. In servicing receivers you too must have had unusual experiences—amusing, dangerous, pathetic and what-have-you. So get out the pen and paper and let us have it. Simply endorse your envelope "Serviceman" C/o Radio & Hobbies, Box 2728C GPO, Sydney, and I guess the editor will see that I get them.

TECHNICAL FLAVOR

Actually we will have to keep him happy by making sure that the anecdotes have a technical flavor, so that yours truly can surround them with a spot of theory and a few appropriate illustrations.

Quite early in my career, I ran up against the classical complaint of hum which had nothing whatever to do with electrolytic condensers and the like. I have been the unwilling victim on another occasion, but the first will suffice.

I was called to service a receiver in one of Sydney's most fashionable suburbs, the members of the household having complained that the receiver smelled something terrible. When I arrived on the scene I had no reason to question their judgment because, despite the sea breeze blowing through the open window, the set was emitting a "hum" which could not be blamed entirely on transformer varnish.

RADIO AND DIRT

The room itself was spotlessly clean but, on moving the radio out from the wall I was faced with the most unbelievable collection of dust, cobwebs and paper scraps. The lady of the house was, of course, most apologetic and explained that she was always afraid to move and clean the radio in case she did some damage to it.

Other housewives of course adopt just the opposite view. The radio must be shifted and cleaned around, even if the darn thing falls to bits. Respectively I would suggest to any female readers of these columns that intermediate course is the best. Just move the radio carefully from the wall and occasionally brush away the obvious accumulations of dust without bending, pushing, screwing or

otherwise disturbing any of the funny little gadgets which decorate the interior of the cabinet.

Getting back to my story, the worst of the dust was cleaned up and I proceeded to remove the chassis from the cabinet in an effort to trace the source of the smell. On turning it upside down, there was ample evidence that a mouse had made himself very comfortable underneath and, in fact, his corpse was still there, curled up in a fantastic pose around the rectifier socket wiring. The immediate cause of the trouble was therefore not difficult to dispose of but, unfortunately, the fragrance lingered on, and the whole receiver had ultimately to go into the shop for the cabinet to be cleaned up, and

ably a grid current effect or a heater-cathode leak.

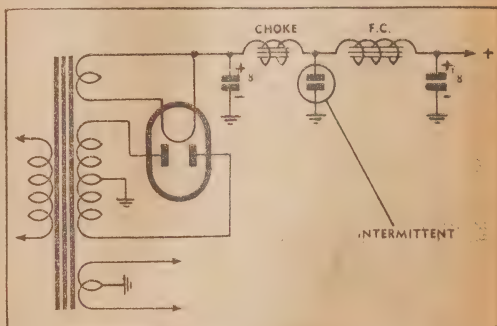
The hum was present, irrespective of a signal, so that it could not have been modulation hum, which is often caused by heater-cathode faults in the converter or one of the high-frequency amplifiers.

TRACING THE HUM

First step was to pull out the driver valve to the push-pull stage, but the hum trouble was still present. Shorting one of the push-pull grids stopped it immediately, and this could have indicated a grid current effect in the particular output valve. However, on changing the valves around in the sockets, it was found that the shorting test still operated on the same socket, showing that the particular valve was not at fault.

Tracing out the circuit showed that the grid at this socket was fed from the plate of the phase-changer, and disconnecting the plate load resistor from B-plus stopped the humming effect immediately. There was

A very tricky hum problem resulted from this intermittent condenser in a two-section filter. It did not affect the high tension voltage or the performance of the set in any way—apart from the periodic variation in hum level.



some of the wiring to be replaced.

I don't suppose we can blame little mice for seeking out such a warm spot on a cold day, but everyone would have been saved a lot of trouble in this case had the manufacturer not been so liberal in designing the cutout for the tuning dial.

I appear to have been talking quite a lot about hum lately, but I am technically serious again. A service call which came in during the month had nothing to do with mice or other obnoxious creatures.

A REAL PROBLEM

The owner of this set was actually rather fussy about hum, and, significantly enough, this receiver was a push-pull job using a two-section filter. It was operating quite normally in other respects, but the hum level would rise and fall intermittently with a faint plop on each occasion. The effect was just noticeable enough to be annoying.

My first impression was that the trouble might be due to a valve, not-

no sign of a leak through the coupling condenser, or any variation in operating conditions, so that the intermittent hum could only be explained in terms of high-tension filtering—or lack of it.

An extra 8 mfd condenser on the rectifier filament, or on the B-plus line showed a small reduction in the trouble, but it was still evident. Placing the condenser between the centre of the filter and high-tension centre-tap cut it out altogether.

But just to be satisfied on the point I left the extra condenser out of circuit and began to "wiggle" the one which served in this position. Sure enough, I found that pressure in one direction on this component produced exactly the effect complained of, showing that there was an intermittent connection inside the condenser.

Replacing it with a new condenser cured the hum permanently. The old condenser was duly mutilated with a pair of cutters and confined to the WPB. Having learned the hard way very early in the piece, I don't leave faulty components lying around the

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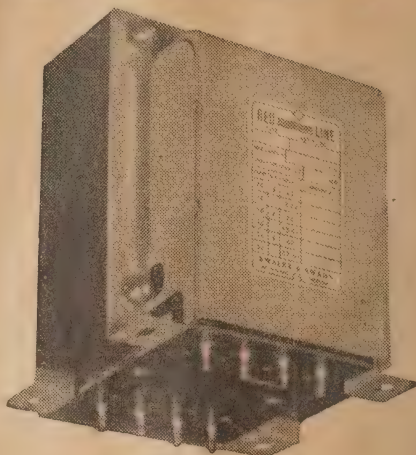
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OF DEPENDABILITY

bench, particularly if they look all right and are intermittent in their properties.

Leave them around, and the chances are that they will be forgotten for what they are and find their way among other spare parts, to cause embarrassment at a later date.

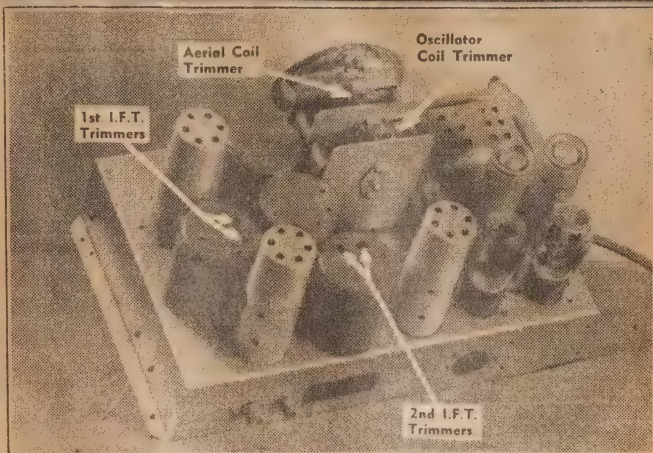
Out of curiosity, I occasionally pull faulty parts to pieces to examine their construction and incidentally find out why they failed. What enthusiast hasn't done the same thing many times over?

QUALITY IMPORTANT

You will find that a paper condenser is just a couple of lengths of thin foil and paper rolled tightly and impregnated with a wax-like substance. All very simple and the beginner could be excused for thinking that he could make his own just as well from letter paper and tin foil. Well, you can make a condenser in this way but not "just as well." The art of making successful paper condensers is to obtain the desired amount of capacitance, make them compact, able to withstand a stated test and working voltage, fit them with good terminal arrangements, give them a certain amount of eye appeal and then sell them at the right price. Last, but not least, the component must have a good service life.

Hence, the dielectric is not any old length of paper. It must be of consistent thickness and free from punctures and blemishes. Paper and foil must be wound evenly, then impregnated and sealed with materials free from ingredients likely to cause cor-

THESE SCREWS ARE IMPORTANT



A favorite trick of the not-so-technical set owner is to tighten the alignment screws, as illustrated in this typical superhet. chassis. Their adjustment is critical and can make or mar the performance of the receiver.

rosion. Two condensers may look exactly the same to the casual observer, but yet be very good and very bad. The difference is all in the control exercised by the manufacturer over the mechanical and chemical properties of the product.

The same remarks go for every other component you like to mention, and it is a poor lookout for any manufacturer who goes into production without an intimate knowledge of his chosen line of business.

I remember many years ago being associated with a factory at a time when a new line of power transfor-

mers appeared on the market. Mechanically, they appeared to be a good job, the voltages were correct and there was no suspicion of trouble on test run. Last, but not least, the price was right and hundreds of sets were produced with the new transformers mounted proudly on the chassis.

But, unfortunately, the manufac-

me just how this can happen, but it does.

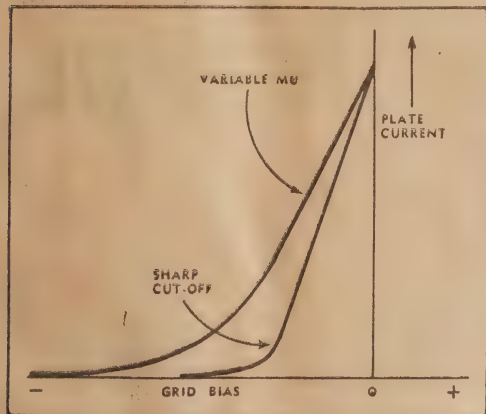
Fortunately, most of the set owners noticed the smell of burning quite early in the piece, and merely switched the set off in a mild panic. But others, more intent on serials or cooking, let it run until the messing-up process was complete and terminated only in the explosion of the fuses. Believe it or not, chassis in this condition had to come back to the factory, be completely stripped, the components either washed or replaced and the whole job reassembled. And, downstairs, the cabinet fitters had to wash and respray the insides of the cabinets to remove the last traces of the mess. Needless to say we weren't caught again.

CROSS MODULATION

I seem to be rambling an awful lot, but, heh, what can one expect after three weeks at the seaside. Long trousers, collar and tie, heavy shoes and radio sets! Surely man wasn't made for these. Guess I'll get over it by next month.

Mr. X had a bright idea. The RF valve in his commercial receiver was in apparent need of replacement and a new one wouldn't leave much change out of a £1 note. But, on searching through the odds and ends in a radio store, he found that good, high gain RF amplifier valves could be purchased—ex disposals—for a few shillings each. Furthermore, they appeared to have a much higher gain than the conventional type.

Our friend knew enough of the technicalities of the business to interpret valve ratings and socket connections, so that in due course the bargain valve was installed. It certainly pepped up the gain of the set, but something was not right. At odd spots on the dial the local



The use of a sharp cut-off valve in the R.F. amplifier stage is likely to produce cross modulation troubles, whether it be an old 24-A or a modern high-slope pentode.

rosion. Two condensers may look exactly the same to the casual observer, but yet be very good and very bad. The difference is all in the control exercised by the manufacturer over the mechanical and chemical properties of the product.

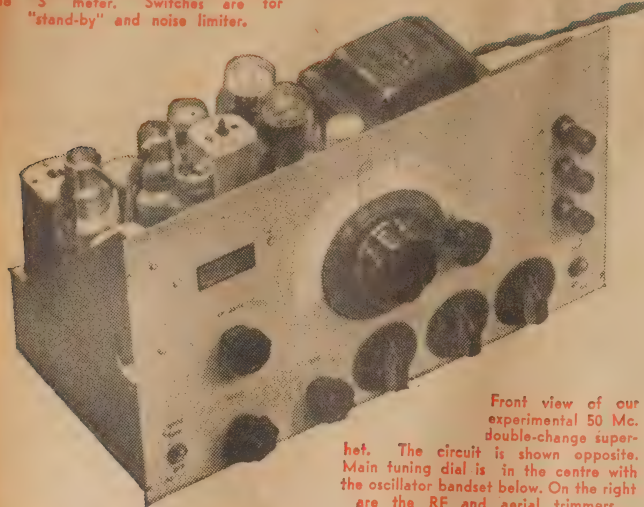
The same remarks go for every other component you like to mention, and it is a poor lookout for any manufacturer who goes into production without an intimate knowledge of his chosen line of business.

I remember many years ago being associated with a factory at a time when a new line of power transfor-

turer had erred somewhere in his choice of raw materials, and it was not long before we had to deal with dozens and dozens of service calls for transformer breakdown — and did those transformers break down! The windings would heat to the point where the varnish and paint exuded as a sticky vapor which invaded every nook and cranny of the set. Every wire was impregnated with it and the sticky brown "goo" was deposited as a coating over the underside of the chassis, up inside the coil cans and put through any hole to the top of the set. Don't ask

(Continued on Page 79)

On the left is the BEO-control and audio gain, with the IF gain underneath the "S" meter. Switches are for "stand-by" and noise limiter.



Front view of our experimental 50 Mc. double-change superhet. The circuit is shown opposite. Main tuning dial is in the centre with the oscillator bandset below. On the right are the RF and aerial trimmers.

broadcast band operation, but difficulties arise with increasing signal frequency. These difficulties include image reception and oscillator pulling.

For the system to be operative, the local oscillator frequency must be maintained accurately 455 kc higher than the incoming signal frequency. It could be 455 kc lower in frequency, but the higher setting simplifies circuit tracking problems and gives increased gain with most frequency changers, due to a regenerative effect.

With a signal frequency of 1000 kc the local oscillator is therefore adjusted to 1455 kc—a ratio of 1:1.455. This arithmetic difference is, of course, maintained at all frequencies, but the ratio progressively diminishes until at very high frequencies the signal and oscillator frequencies are of much the same order. Thus, if the signal is on 10 mc, the local oscillator will be on 10.455 mc and the ratio has diminished to 1:1.0455.

The image is always displaced from the true signal position by twice the intermediate frequency, in this case 910 kc. There is little or no chance of image reception on the broadcast band, firstly because the images are outside the tuning range of the receiver, and secondly because the sig-

Double Change Superhet Design

Despite its apparent complication, the double change superhet principle has a number of advantages to offer, particularly for reception at V.H.F. This preliminary article examines the limitations of conventional superheterodynes and sets out the basic requirements for a double change receiver.

Now a "double super" the incoming signal frequency is changed twice before reaching the detector. The principle is by no means new, being utilised wherever a short-wave converter is coupled ahead of a conventional superhet.

The point of interest about a double change superhet is that the circuits at the frequencies are selected for optimum performance and convenience rather than being a random combination of separate units.

The factors governing the choice of intermediate frequency in a double change superhet are the same as those which have to be considered in the design of a double change receiver, so that some consideration of the same will not be out of place.

At the present time most superhet receivers employ an intermediate frequency in the vicinity of 455 kc. At this frequency it is possible and convenient to build straightforward IF amplifier channels giving ample gain and any desired degree of selectivity from a wide band-pass characteristic to the knife-edge response of a crystal filter. Broadly speaking, an IF of 455 kc is satisfactory for

normal tuned circuit is well able to reject frequencies 910 kc out of position.

On the short-waves, however, 910 kc represents relatively small portion of the spectrum. The ratio between the true signal frequency and the image position is so small that the signal frequency circuits are unable effectively to reject the image. Thus, we have the familiar circumstance in dual wave receivers of the same station appearing twice on the dial or, alternatively, of interference between stations actually separated by twice the intermediate frequency.

The second effect is that of oscillator pulling, or the tendency for the local oscillator to lock in with the frequency of the incoming signal, so that no beat note is produced. To a less serious extent, pulling may be evidenced as an interaction between the alignment of the signal and oscillator-tuned circuits. The effect is not apparent on the broadcast band, but is likely to become troublesome at frequencies higher than 10 mc, depending on the nature of the fre-

by W. N.
Williams

frequency changer. Increasing the intermediate frequency results in a greater difference between signal and oscillator frequency and reduces pulling effects.

Summing up these remarks, a receiver using a 455 kc IF channel can be made to give entire satisfaction over the broadcast band, and up to a frequency around the 7 mc amateur band. Beyond that the problem of image reception increases, so that, at 14 mc, it is difficult to obviate image troubles completely, even with an efficiently tuned RF stage ahead of the converter.

At 28 mc serious trouble can be expected from both image reception and oscillator pulling, and it becomes progressively worse until the absolute limit of usefulness is probably reached at a signal frequency of 50 mc. Even allowing for care in design, a 50 mc receiver, using a 455 kc IF channel, is normally a "cranky" one to handle.

I.F. AT 1900 KC.

It follows from the above that, for signal frequencies above about 15 mc, a clear case can be made for the use of a higher intermediate frequency — at least from the point of view of image reception and oscillator stability. The next more or less standardised intermediate frequency is at 1900 kc, and, as might be expected, the remarks for a 465 kc channel apply, if the signal frequencies are simply multiplied by a factor of four. Thus, a receiver with a 1900 kc IF channel is good for frequencies from about 2 mc to 60 mc, beyond which a still higher intermediate frequency becomes desirable.

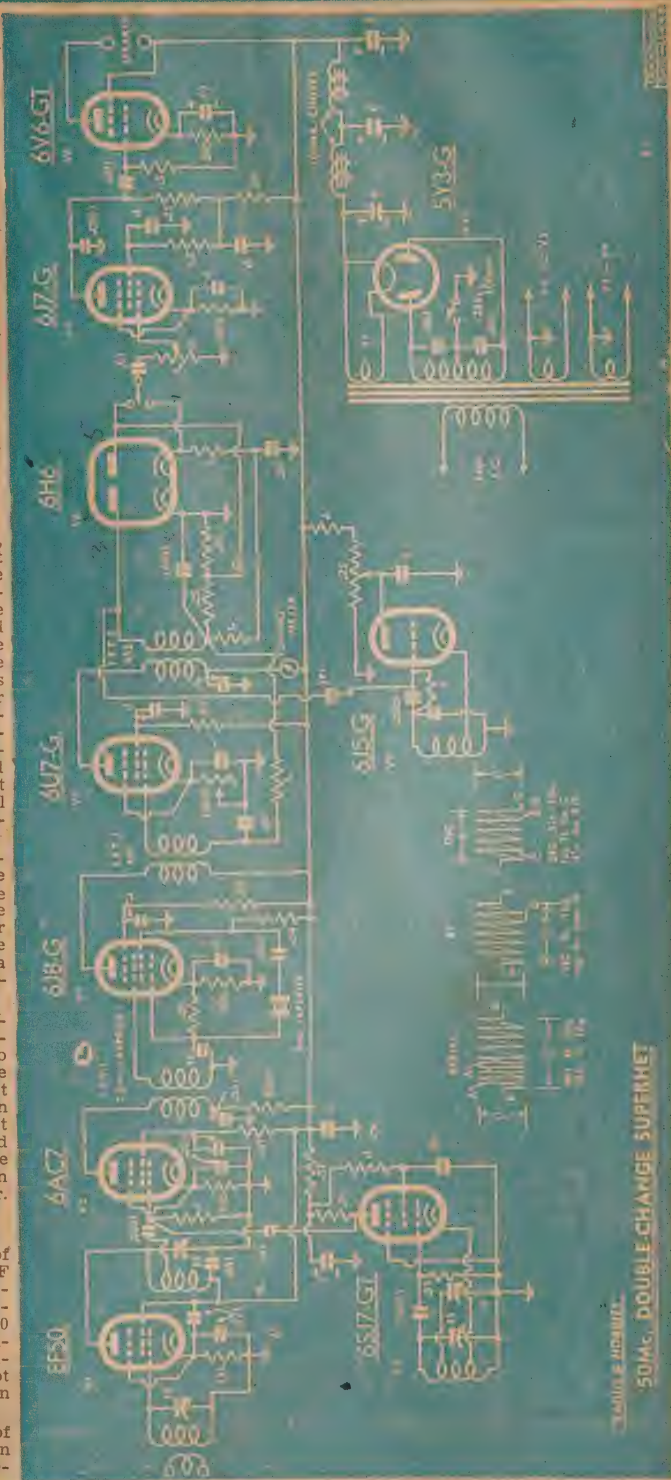
At first glance, a 1900 kc IF channel would therefore appear to be an excellent choice for a short-wave receiver, since it ensures favorable operation of the frequency changer over all bands in which the average amateur is interested. However, a new and serious problem arises — namely that of selectivity.

Since the frequency of the IF channel is roughly four times the conventional figure, it is reasonable to assume that the band width will be multiplied by a similar factor. It is not unusual for communication or amateur receivers to use at least three and up to five double-tuned IF transformers at 465 kc to give a very sharp selectivity curve even without the use of a crystal filter.

SELECTIVITY PROBLEM

To achieve the same degree of selectivity and maintain the same IF channel gain at 1900 kc would necessitate a much more complicated set-up. Add to this the fact that 1900 kc crystal filter systems are expensive and scarce, and it is not difficult to see why this frequency is not widely employed in communication receivers.

The problem of selectivity is, of course, of paramount importance in the 14 mc amateur band and like-



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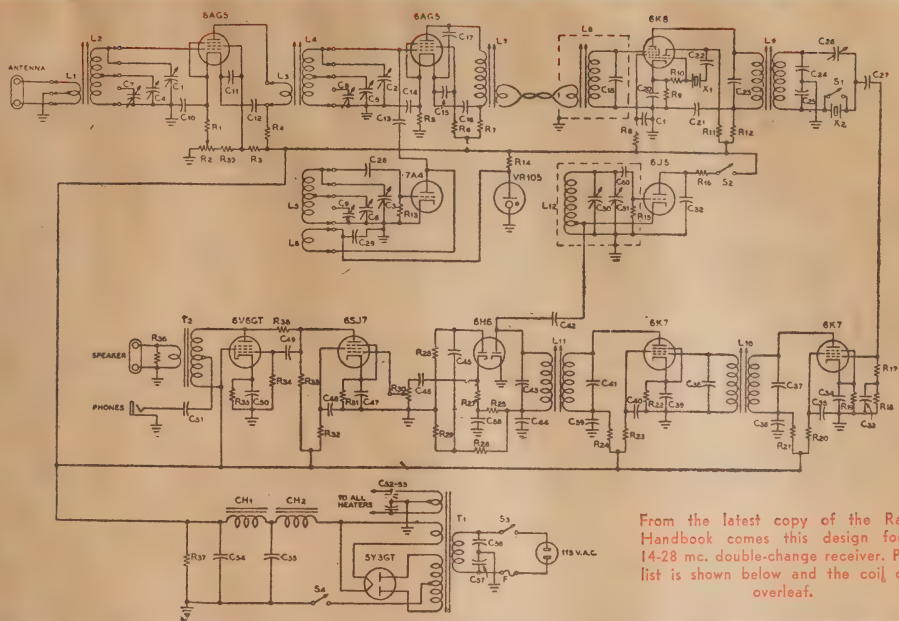
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A CIRCUIT INTENDED FOR 14 AND 28 Mc.



From the latest copy of the Radio Handbook comes this design for a 14-28 mc. double-conversion receiver. Parts list is shown below and the coil data overleaf.

wise at 28 mc, when that band is open. It is much less important at 50 or 144 mc, but increasing use of these bands will inevitably demand higher selectivity than many receivers at present possess.

Many of the receivers in use at present on the 144 mc amateur band use a 10.7 mc IF channel, which finds its application in radar, fm and television equipment, but is sadly lacking from the point of view of selectivity. Poor selectivity is something of an advantage just now, because many of the 144 mc transmitters are subject to frequency modulation. However, these will inevitably be replaced by crystal controlled types.

There is, therefore, clear conflict between the requirements of a high intermediate frequency to ensure good

performance of the oscillator and signal circuits, and, on the other hand, a low intermediate frequency to give good selectivity without an excessive number of stages. The answer to the problem lies in the double change superhet. principle and consideration of it is warranted for all signal frequencies above about 10 mc. In considering the design of a double change superhet., it is perhaps best to begin at the loudspeaker end and work forward. The first observation is simply that the detector and audio system is entirely conventional. What is provided in the way of power output, gain, noise silencing, &c, is entirely a matter for the individual constructor.

In front of that comes the low frequency IF channel which largely

determines the adjacent channel selectivity, contributes much of the overall gain and provides the basis for gain control and operation of the "S" meter.

The adjacent channel selectivity of preceding tuned circuits can largely be discounted, and the characteristics of the whole receiver in this direction substantially will be those of the low frequency IF channel. If the receiver is destined mainly for use in the 14-28 mc region very high selectivity is an advantage even to the complication of adding a crystal filter system. For 50 mc work, such a degree of selectivity is not required while, for still higher signal frequencies, it would be a positive disadvantage.

A second intermediate frequency

Parts list for the Double-Conversion Superheterodyne

- | | | | |
|-------------------------------------|---------------------------------|-------------------------------------|---------------------------------------|
| C1, C2, C3—3-gang 35pf. | C44—100pf. midget mica. | R11—100,000ohms 1/2 watt. | R37—50,000ohms 20 watts. |
| C4, C5, C6—100pf air padders | C45—0.05mfd. 400v. tub. | R12—200ohms 1/2 watt. | R38—470,000ohms 1/2 watt. |
| C7, C8, C9—50pf air padders | C46—0.01mfd. 400v. tub. | R13—10,000ohms 1/2 watt. | R39—47,000ohms 1/2 watt. |
| C10, C12, C14, C16—0.005mfd. mica | C47—25mfd. 400v. tub. | R14—300ohms 10 watts. | L1, L2, L3, L4, L5, L6—See coil table |
| C11, C15—0.01mfd tub | C48—0.1mfd. 400v. tub. | R15—47,000ohms 1/2 watt. | L7, L8—18 turns No. 24 enam. close |
| C13—5pf midget mica. | C49—0.01mfd. 400v. tub. | R16, R17, R18—100,000ohms 1/2 watt. | wound on 1/2in. XR-50 coil form |
| C17, C18—50pf. silver mica | C50—25mfd. 25v. elect. | R19—470ohms 1/2 watt. | with 3-turn coupling links. |
| C19—0.02mfd 400v. tub. | C51—0.05mfd. 400v. tub. | R20—68,000ohms 1/2 watt. | L9—470ka. crystal-filter trans. |
| C20—0.1mfd 400v. tub. | C52—C53, C56, C57—0.002mfd mica | R21—200ohms 1/2 watt. | L10, L11—470kc. i-f transformers. |
| C21—0.01mfd. 400v. tub. | C54—20mfd. 450v. elect. | R22—470ohms 1/2 watt. | L12—470kc. b-f-o transformer. |
| C22—0.002mfd. mica. | C55—8mfd. 450v. elect. | R23—48,000ohms 1/2 watt. | T1—700v. ct. 90ma., 5v. 3a., 6.3v. |
| C23, C24, C25, C26—Capacitors in | C56—8mfd. 450v. elect. | R24—200ohms 1/2 watt. | 3.5a. |
| 1-f trans. | C58—C59—Dual 0.1mfd. 400v. | R25—1.0 megohm 1/2 watt. | T2—Push-pull plates to voice coil. |
| C27—0.006mfd. mica. | C60—250pf. midget mica. | R26—100,000ohms 1/2 watt. | CH1, CH2—0.5hy. 110ma chokes. |
| C28—50pf. midget mica. | R1—200ohms 1/2 watt. | R27—1.0 megohms 1/2 watt. | S1—Crystal-filter switch in trans- |
| C29—0.005mfd. mica. | R2—500ohm potentiometer | R28—470,000ohms 1/2 watt. | former. |
| C30, C31—Capacitors in b-f-o trans. | R3—47,000ohms 1/2 watt. | R29—500,000ohm potentiometer. | S2—S.p.s.t. b-f-o switch. |
| C32—0.01mfd. 400 volt tubular. | R4—200ohms 1/2 watt. | R30—220,000ohms 1/2 watt. | S3—A-c line switch. |
| C33, C34, C35, C36—0.1mfd. 400v. | R5—470ohms 1/2 watt. | R31—100ohms 1/2 watt. | S4—Plate-voltage switch. |
| C37, C38—Capacitors in i-f trans. | R6—68,000ohms 1/2 watt. | R32—470,000ohms 1/2 watt. | F—3 ampere fuse. |
| C39, C40—0.1mfd. 400v. | R7—1000ohms 1/2 watt. | R33—220,000ohms 1/2 watt. | X1—5000kc crystal. |
| C41, C42—Capacitors in 1/2 trans. | R8—22,000ohms 2 watts. | R34—270,000ohms 1/2 watt. | X2—470kc. crystal in i-f trans. |
| C42—Twisted-wire capacitor | R9—180ohms 1/2 watt. | R35—270ohms 2 watts. | |
| | R10—270,000ohms 1/2 watt. | | |

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of about 175 mc is sometimes used, making possible very high selectivity without a crystal filter system. The disadvantages are firstly the relative scarcity of 175 kc components and secondly the requirements imposed upon the preceding frequency changer, which may itself be stepping down from a frequency of from 5-10 mc.

Considering these factors it is difficult to gainsay the use of 455 kc as a second intermediate frequency.

As far as gain is concerned, it need not actually be higher in this section of the receiver, than that necessary to produce a healthy background of noise in the output with gain controls advanced and the signal grid of the second converter shorted to earth.

Assuming optimum design, sufficient gain can be provided by a single 455 kc IF stage and two transformers. Selectivity with this arrangement will be ample for a 50 mc superhet. or higher. For lower frequency work, two IF stages at 455 kc are to be preferred, operating either at reduced gain or in conjunction with a crystal filter.

SECOND CONVERTER

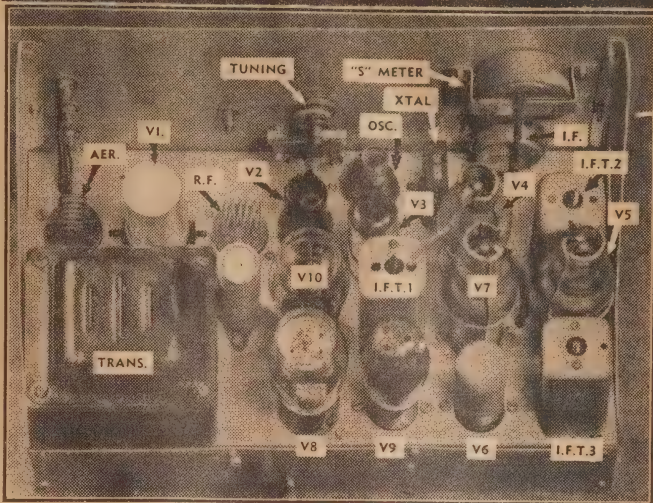
For the rest, the IF channel follows quite standard practice. AVC will normally be used for phone work, with provision for switching to manual gain control for CW.

Next important link in the chain is the second frequency changer, which operates normally with an input signal of from 5 to 10 mc and delivers its output at 455 kc.

Provided the gain ahead of the second converter is fairly high—and it should be so—the signal-to-noise ratio in this stage is not a major consideration. The overall signal-to-noise ratio of the receiver will already have been established in the RF stage and first frequency changer.

For the above reason a conventional converter valve can be used quite conveniently. Frequency stability is a major requirement for the rather obvious reason that any drift in the second frequency changer may add to that of the first. The oscillator tuned circuit must therefore employ very rigid non-drift construction and the components be so placed and

50 Mc. RECEIVER—REAR VIEW



Layout of components in the 50 mc. experimental receiver follows a fairly orderly pattern. The compact chassis brings the power transformer rather close to the R.F. circuits, but a slightly wider chassis would overcome this objection.

shielded that the possibility of hand capacity effects is obviated.

Another important point arises from the fact that the second oscillator operates normally at a lower frequency than the signal circuits, and, if the frequency discrepancy is wide, harmonics from the lower frequency oscillator may appear in the signal frequency circuits as unmodulated carriers. Extreme care with layout, shielding and filtering would be necessary to obviate this effect, and for an amateur 'band receiver at least, it is much easier to take only a reasonable amount of care with layout, but select the second oscillator frequency carefully so that its harmonics cannot fall in the amateur bands.

Problems of stability and shielding are greatly simplified if the second oscillator is crystal controlled—a scheme which becomes entirely practical in these days when hundreds of

odd crystals are on sale at a few shillings each. Provided a frequency of the right order can be selected, it is possible by this means to minimise frequency drift and shielding requirements, and, at the same time, overcome the rather ticklish problem to many constructors, of discovering the exact frequency on which the second oscillator is operating.

Of course, the use of some available crystal may necessitate an odd frequency in the first IF channel but, as we shall see later, this is often less of a problem than that of getting the second oscillator on frequency and maintaining it accurately with a conventional tuned circuit.

CRYSTAL CONTROL

Assuming that crystal control is employed for the second oscillator, the simplest arrangement is the Pierce circuit, in which the crystal is connected directly between plate and grid, in series with the blocking condenser; no auxiliary tuned circuits are required. We duly checked the operation of this circuit with a 6J8-G valve and experienced no difficulty with it. There is no obvious reason why the Pierce circuit should not operate equally well with other types.

Assuming that the oscillator is to operate at a higher frequency than the incoming signal, the preceding input circuits must be resonated to the frequency of the crystal, less 455 kc. Putting things the other way round, the second oscillator frequency must obviously be made equal to the first intermediate frequency, plus 455 kc. Thus, a 10.7 mc first intermediate frequency would require a second oscillator frequency of 11.155 mc to convert it to 455 kc.

COIL TABLE

DOUBLE-CONVERSION SUPERHETERODYNE FOR 10 AND 20

BAND	R-F AND DETECTOR COILS	OSCILLATOR COILS
28 Mc	SECONDARY 12 turns No. 20 bare spaced to 3/4 inches. Tapped at 10 turns.	GRID COIL 6 turns No. 20 bare spaced to 1/2 inch. Tuning capacitor across entire coil.
	PRIMARY 5 turns No. 20 enam. close spaced. Separated 1-8in. from secondary	PLATE COIL 4 turns No. 20 enam. close spaced. Separated 1-8in. from grid coil.
14 Mc	SECONDARY 20 turns No. 20 enam. spaced to 3/4 inches. Tapped at 16 turns.	GRID COIL 7 turns No. 20 bare spaced to 1/2 inch. Tuning capacitor tapped 5 turns from ground end.
	PRIMARY 7 turns No. 24 enam. close spaced. Separated 1-8in. from secondary.	PLATE COIL 5 turns No. 20 enam. close spaced. Separated 1-8in. from grid coil. stated, probably 1/2".

All coils shielded, with iron slug. Diameter not

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807 8/6
EA50 6/6
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In the normal way a figure of 11.155 mc is too high for simple crystal control and a conventional tuned circuit would be necessary.

Just in passing, we investigated the operation of a converter with a 5.55 mc (approx) crystal with the idea of using the second harmonic on 11.1 mc to produce the required beat frequency. However, the conversion efficiency with this scheme was very low, and some external injection method would have been essential which favored the second harmonic and excluded the fundamental.

SELECTING A CRYSTAL

The majority of disposals type crystals which fall into the "five bob" class have a frequency of just over 8 mc, and, happily enough for this purpose, the harmonics fall outside the amateur bands. Assuming the use of 455 kc as the second IF, such a crystal would put the first IF at between 7.5 and 8.0 mc. A first IF of this order, or indeed up to 10.7 mc is well suited to the requirements of a receiver intended to tune to 28 mc or higher in receivers intended for the lower frequency amateur bands, current overseas design appears to favor a first IF in the vicinity of 5 mc.

For amateur band work it is not necessary to achieve any great amount of gain in the first IF channel and, in fact, it is perfectly practicable to feed the output from the first frequency changer direct into the grid of the second frequency changer using any convenient method of tuned coupling. A possible exception to this would arise on the 144 mc band or higher with a converter system giving low conversion gain and low noise. In this case it would become necessary to provide some gain in the first IF channel. The design of radar and FM equipment over the past few years has covered very effectively the circuit arrangements for high frequency IF channels, especially those around 10 mc. Valves like the 6AC7, EF50 or VR65 are an obvious choice.

TUNING CIRCUITS

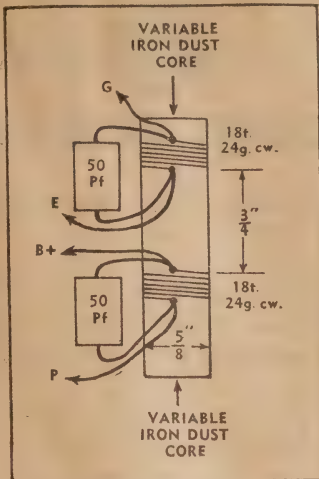
The RF amplifier stage and first frequency changer follow conventional superhet. practice, except that there is a wider margin of difference between the signal frequency and oscillator circuits.

For signal frequencies up to about 15 mc conventional valves and circuit techniques are adequate. Providing the receiver has an efficient RF stage, a conventional converter valve will suffice as the first frequency changer.

The same general set up will operate quite well up to 30 mc, although a noticeable improvement is possible with more specialised design.

At 50 mc it is well worth while to select carefully valve types and circuit arrangements. One preferred scheme is to use a high slope pentode as the mixer valve, with separate oscillator and grid injection. Valves like the 6AC7 and EF50 operate very well in this service at 50 mc

7.5 mc Transformer



Showing the essential details of a suitable 7.5 mc I.F. transformer.

and are likewise effective as RF amplifiers.

Their input loading characteristics become troublesome at still higher frequencies and, to achieve equivalent results at 100 mc and beyond, it is necessary to use a valve like the 6AK5, which combines high transconductance with small physical dimensions.

In this region, however, excellent results can be obtained by adopting precisely the opposite approach. This involves using special triodes in the RF amplifier and mixer stages, giving lower gain, but nevertheless, a very favorable signal-to-noise ratio. With such an arrangement, at least one stage of amplification would probably be necessary at the first intermediate frequency.

PRACTICAL DESIGN

Many of these observations are made as a result of work done in recent weeks with a 50 mc double-change receiver. This began life as a three-valve converter using a 954 as RF amplifier, 6AC7 as mixer with a 954 as pentode oscillator. The circuit and a few relevant details were given on Page 75, of the Australian Short-wave Handbook and in the August, 1947, issue of Radio and Hobbies.

It was subsequently decided to build this converter up as a complete receiver, chiefly for convenience of operation. The obvious course was to add a two-stage 1900 kc IF channel and more or less duplicate the circuit featured on Page 32 of the March issue.

However, from an experimental point of view, there appeared to be little virtue in simply duplicating an existing receiver and we decided to follow the more difficult course of building the converter up as a complete double-change superhet.

Although the principle of double frequency change is well known and recognised in communication circles we found that comparatively few designs have been published and we were left more or less to our own devices to evolve what we considered, to be a circuit suitable for amateur requirements. But the very same week that we handed our circuit to the draftsman for his attention we received a copy of the latest Radi Handbook featuring a double-change receiver.

Although their design is intended primarily for the lower frequency bands and includes a crystal filter, the fundamentals of both circuits proved to be very similar.

THE CIRCUIT

Looking through our complete circuit it will be noted that an EF5 serves as RF amplifier. This valve gives high gain and, despite its adverse input loading characteristics the tuning is quite sharp. The 6AC is retained as mixer valve, while 6SJ7-GT is used as a pentode oscillator.

Aerial, RF and oscillator coils are tuned by 35 pf midget condenser which are mounted on the front panel as hand trimmers. A separate 15 pF midget condenser is connected across the oscillator coil and is operated by the main tuning dial. Some adjustment to the aerial and RF condensers is therefore necessary for any marked change in the oscillate setting.

It is not possible at this stage to enter into a lengthy discussion of constructional methods except to say that well-known techniques should be followed. The leads to the tuning coils and condensers must be short and direct, and likewise it leads to screen and cathode bypass condensers. In fact it is a good scheme to pick a convenient earth point adjacent to the cathode pin and return all leads and components to it. The components for each stage should be grouped in compact fashion and arranged to minimise unwanted interstage coupling.

While on the subject of the RF end, we found that it was essential to decouple the plate and screen supply of the high frequency oscillator as a precaution against modulation hum. For the same reason we found it desirable to place mica bypass condensers across the high tension secondary winding.

PLUG-IN COILS

As in the original converter the coils plug into 6-pin sockets, so that the receiver can be used, if desired for the lower frequency band. Thanks to the use of separate hand trimmers it is not necessary to match the coils exactly. Also, by carefully placing all the coil sockets at tuning condensers, the connecting leads need to be no longer than solder lug, so that the facility of plug-in coils is obtained with little or no sacrifice in efficiency.

The second converter is a 6J8-C in which the triode portion is operating as a crystal controlled oscillator.

(Continued on Page 83)



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FOR THE JUNIOR EXPERIMENTER

Last month we "dissected" rather thoroughly the Reinartz reaction circuit, as commonly used in one-valve receivers. In the following article, we comment on other types of reaction circuit and control.

JUST before passing on, there is one point which calls for explanation, namely the function of the resistor and condenser in the detector grid circuit.

The grid is normally returned to earth, with this type of detector, so that it has no initial negative bias. However, in the presence of an incoming signal, the grid should acquire a small negative potential, which varies in magnitude with the modulation. This varying negative voltage on the grid has an effect on the plate current and causes an amplified version of the signal to appear in the plate circuit.

Very obviously, the detector grid could not acquire a negative bias if it were returned to earth directly or through the very low d-c resistance of a tuning coil. Hence, it is necessary to insert a condenser between the coil and the grid and this will have the effect of passing on the RF signal, while isolating the grid from ground, as far as d-c potential is concerned.

GRID LEAK

But it is not satisfactory to leave the grid floating and a high value of resistance must be connected between grid and earth. This can be installed direct or across the grid condenser or, in some case, between grid and A-plus. The exact connection seldom makes a great deal of difference to the performance, but you can try the alternative connections as a matter of interest.

The grid condenser is usually between .0001 mfd. and .0005 mfd., while the grid resistor value varies from about 0.5 megohm to 2.0 megohms. The exact values are not critical and there is no harm in experimenting

with them to note the effect—if any. However, it is unwise to increase either the capacitance or the resistance value above the figures mentioned, owing to the likelihood of "squegging" effects occurring.

So much for that subject.

Now for a few reaction circuits.

The variable reaction condenser in the Reinartz circuit can be replaced by a fixed condenser and reaction control effected by means of a potentiometer in the plate circuit. Increasing the plate voltage will cause the valve to oscillate, while reducing it will have the opposite effect.

FIXED CONDENSER

If the fixed reaction condenser is made .0001 mfd. in the standard circuit, there is a good chance that the detector will go in and out of oscillation at a satisfactory plate voltage. Too large a fixed condenser may mean oscillation with a very low plate voltage, leading to some loss in detector efficiency. With too small a condenser, reaction may be difficult to obtain over the whole band.

The use of a potentiometer as a reaction control often has an advantage in compact receivers, because a potentiometer is smaller physically than most reaction condensers. It is also cheaper.

POT BYPASS

There are a couple of other points about this circuit worthy of special mention. In the first place, the resistance of the potentiometer is in series with the primary of the coupling transformer—or the earphones—and, if precautions are not taken, part of the audio energy would be wasted uselessly across the potentiometer

element. This can be prevented by bypassing the moving arm of the potentiometer to earth with a condenser. The condenser should be at least 0.5 mfd. if serious losses are to be avoided in the bass register.

The other point concerns the low potential end of the potentiometer. If it is simply left floating, the potentiometer acts as a series resistor, reducing the voltage, as the resistance in circuit is increased. Since the plate current of the detector is very low, it may or may not be possible to achieve sufficient voltage drop across the resistor to give full control over the reaction.

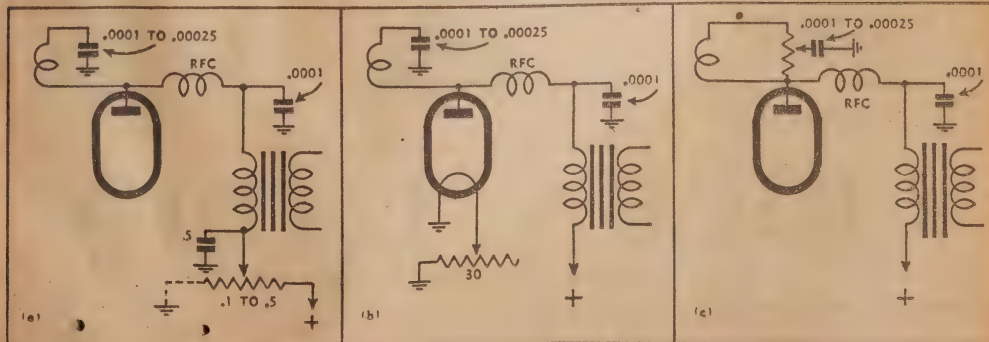
If the potentiometer is to be used as a series resistor, it is wise to use the highest available value, usually about 1.0 megohm. Assuming that sufficient control is obtained by this means, the most likely failing of the circuit is a "lag" effect in the operation of the potentiometer, the detector going in and out of oscillation at quite different settings of the potentiometer, as it turned in opposite directions.

BEST CONNECTION

In most cases, better results are obtained by earthing the low potential end of the potentiometer, as shown dotted in circuit (a). This means that the detector plate voltage can be reduced to zero, so that there is never any question of the control not being fully effective.

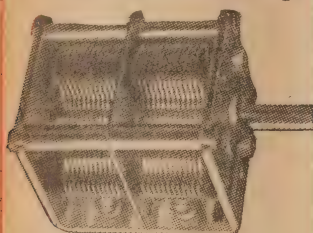
However, the potentiometer element is across the high tension supply and imposes a load on it. Provided the potentiometer value is high, the load current will be so low as to be of no consequence while the receiver is in operation.

However, it would become serious



A page of new lines from Sydney's Leading Radio Store

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if the small bleed current were to flow during the long periods of idleness, so that some means has to be included to open the circuit. This involves a switch in the earth return of the potentiometer, or one wired in series with the B-minus lead to the receiver. Alternatively, you can remove the battery plug from the chassis, when the receiver is not in use. Note that it is not possible to break the filament and high tension circuits effectively with a simple off-on switch. It is essential to use two separate switches or a double-pole type.

An alternative method of reaction control is shown in circuit (b). This is not much used nowadays, although it was once almost universal. In this circuit, the reaction is controlled by varying the filament voltage. A 30 ohm rheostat is usually satisfactory for modern low current 2.0 volt valves, although a higher value is sometimes preferable for valves like the A409 or A609, which have low current higher voltage filaments. For heavy current filaments a lower value is often better, something around 20 ohms.

The chief disadvantage of a filament control is the time lag in its operation, the filament temperature taking perceptible time to increase or decrease with variations of the rheostat.

RHEOSTAT

On the other hand, many constructors of small sets like to install a detector filament rheostat as an auxiliary reaction control. They claim that a tendency to "ploppiness" or fierce operation or to fringe howl can be overcome by judicious reduction of the detector filament voltage.

The third circuit is typical of several arrangements which involve connecting a variable resistor across the reaction winding itself. There are too many individual variations to show them all.

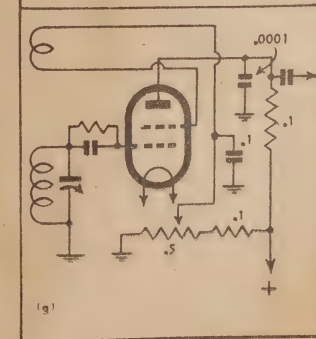
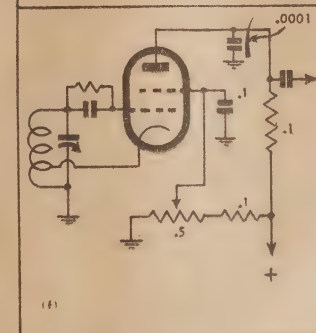
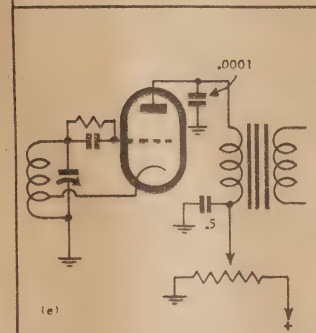
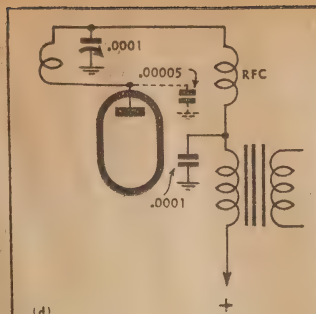
In circuit (c), the reaction winding is fully operative when the condenser is at the remote end of the coil. In the opposite setting, the condenser bypasses the plate direct to earth and little or no RF energy flows through the reaction coil. In between, there are intermediate settings where the resultant of the two effects leaves the detector just on the verge of oscillation.

VARIATION

An obvious variation is to have the condenser between the plate and the reaction coil, earthing the spindle of the potentiometer direct. Still another idea is to use the potentiometer to short out the reaction coil, thereby eliminating its effect by brute force. The control, in all these cases, usually has a resistance value of between 500 and 1000 ohms.

The chief difficulty about the arrangement is the possibility of hand capacity effects and losses in the reaction circuit, due to long leads.

In circuit (d), the reaction coil is



Here are a few more typical reaction circuits which you can try out. A similar collection of circuits appeared in the April and May issues last year, together with relevant remarks. These and the foregoing circuits cover the main methods.

wired in series with the output circuit, the reaction condenser functioning as in the conventional Reinartz arrangement. In most cases it can be regarded as a mere variation of the latter, but there are cases where it will operate better, owing to secondary circuit effects. For example, the series arrangement may operate better if the R.F. choke is not the best.

Circuit (e) differs basically from all those previously mentioned, in that the regenerative effect is achieved in the cathode rather than the plate circuit. It is applicable mainly to indirectly heated valves, and involves tapping the cathode on to the coil a short way up from the earthed end. In practice, the tapping should be no farther from the earthed end than is necessary to achieve smooth reaction with suitable plate supply voltage.

In circuit (e), the reaction is controlled by means of a potentiometer in the plate circuit. There is no need for an RF choke, however, as the plate leads are not involved in the reaction circuit.

TAPPED COIL

The tapped coil arrangement is applied most frequently to pentode detectors, as shown in circuit (f), being particularly popular for regenerative shortwave receivers. The suggested constants are typical but are subject to amendment in individual circuits.

Reaction is controlled by varying the screen voltage and it is noteworthy that no RF chokes are required in either the plate or the screen circuits. The amount of regeneration can be adjusted for optimum result by varying the position of the cathode tapping on the coil. Since the detector is a pentode, the plate load is preferably a resistor, transformer coupling tending to give poorer tonal qualities with a pentode, without increasing gain to any extent.

The obvious difficulties about the cathode tapped circuit is the need for a non-standard coil and its difficulty of application with battery valves.

AMENDED CIRCUIT

An amended circuit, which can use commercial "Reinartz" coils is shown in circuit (g). Here the reaction is obtained in the screen circuit, which also provides the means of control. This circuit has been used in many Radio & Hobby small sets and is noted for the smoothness of control and its tolerance variations in coil design.

So much then for reaction, and variety of circuit arrangement which you can try out at your leisure. But, as we pointed out last month, don't fall into the trap of assuming because a particular circuit works well in your case, that it is necessarily the best of the bunch. All kinds of secondary factors can influence the final result in a particular case, and an open mind should be preserved in all these matters.

WE'VE been saying all along that it couldn't be done, that you could not have variable selectivity in a simple receiver. But here it is—true variable selectivity at the cost of a switch and three or four wiring parts. Add to this unique feature an 807 output valve, negative feedback and tone compensation, and you have the basis for the finest five valve set you are likely to hear for many a day.

Fidelity

5

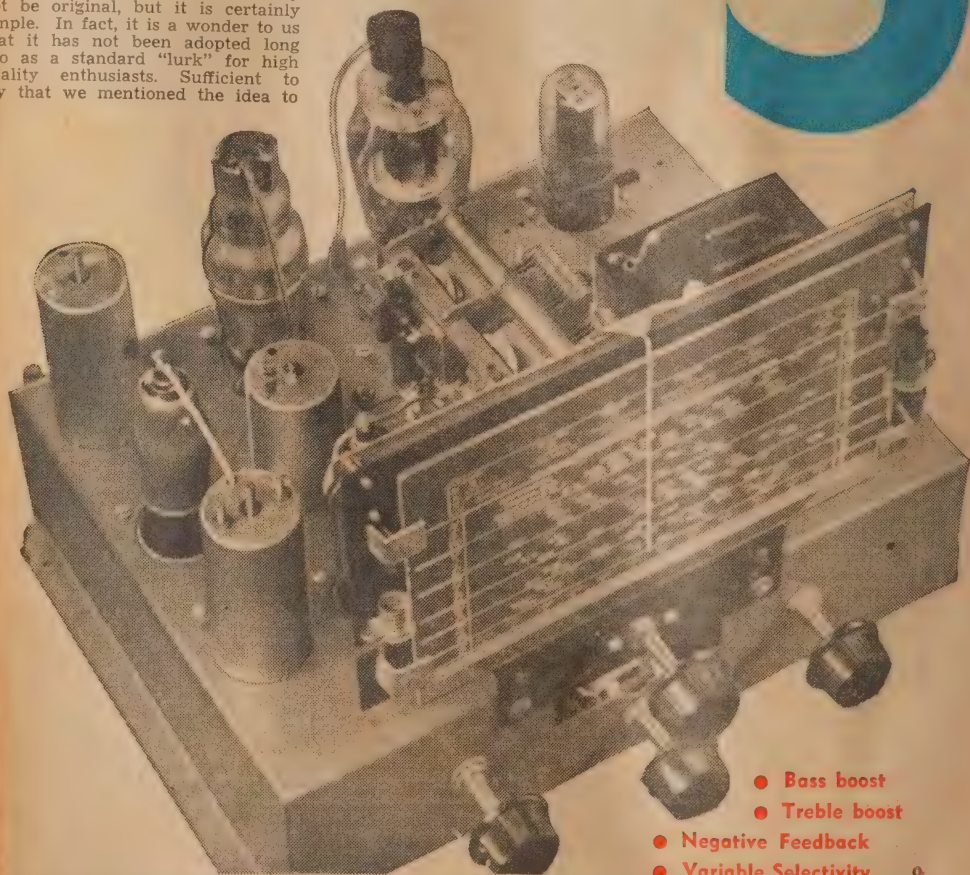
TRADITIONALLY we restrain our enthusiasm about new designs, but, when we took it home for a weekend, this set really "got us." With the selectivity wide open, and operating into a simple stereoscopic speaker setup, the reproduction of the national programmes in particular was really something to write home about. Voices had that "presence" and music the "edge" which we have associated before only with much more elaborate equipment.

Just a flick of the switch, and the set was back to a straight superhet., with all the gain and selectivity necessary to log the weaker and more distant stations.

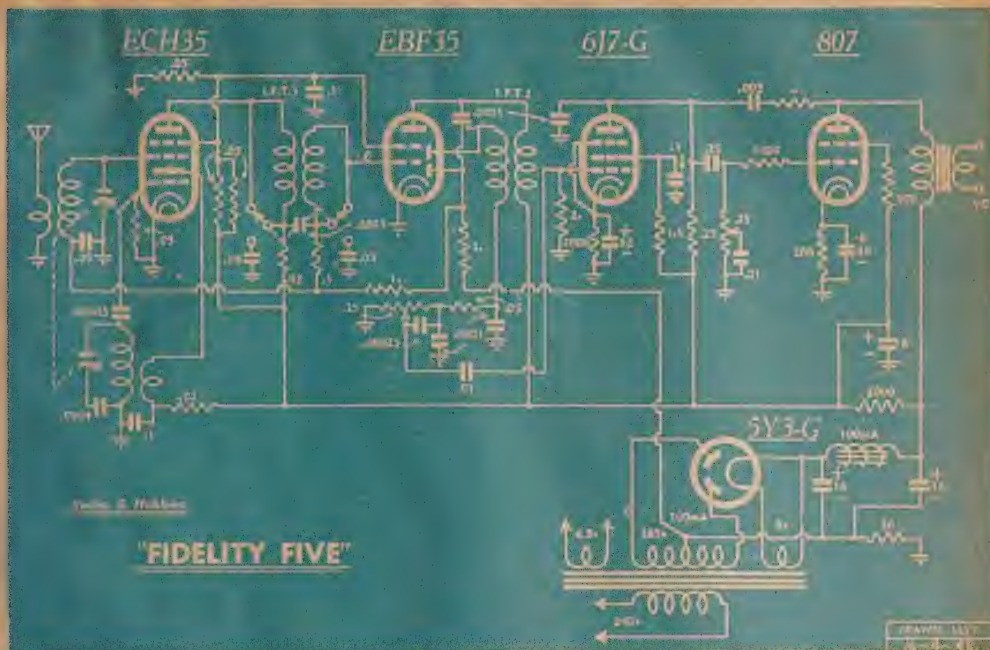
The particular scheme may or may not be original, but it is certainly simple. In fact, it is a wonder to us that it has not been adopted long ago as a standard "lurk" for high quality enthusiasts. Sufficient to say that we mentioned the idea to

several prominent design engineers who reacted in much the same way . . . "so simple, it's darned clever."

It seems that we have been talking for months about tuners—broad band and otherwise—so that the relevant problems should be well understood. In the absence of simple variable selectivity arrangements, readers have elected to use either a sharp or a broad tuner system, according to their taste, or one of each, if they could afford it.



- Bass boost
- Treble boost
- Negative Feedback
- Variable Selectivity



Here is the schematic circuit, which incorporates several interesting features. A variable padder condenser will be required for coils not fitted with variable iron cores.

But there are plenty of listeners who cannot stand the expense or the complication of more than one receiver, and it is to such listeners that this new receiver will appeal. To all intents and purposes, it is a standard five-valve receiver, which handles and tunes just like any other similar set. But, when father wants the symphony, or Johnny wants the jazz, with something like its original balance, he just flicks the selectivity switch, turns up the gain slightly and there it is—wide range sound.

There is so little to it, that the facility can be added to existing receivers, broadcast or dual-wave, for just a few shillings.

We had been toying with the idea of variable selectivity for quite a while, and progressively rejected all the usual schemes. Tertiary wind-

ings or variable spacing in IF transformers isn't the answer for the home constructor, because he cannot buy the essential parts and, in any case, might not be able to carry out the necessary alignment adjustments.

The desired effect can also be achieved by an arrangement of condensers to vary the coupling and tuning of the transformers, but it is a work of art to get the scheme operating properly, quite apart from the complication and cost.

Then there is the other idea of loading the transformer windings by resistors to reduce their "Q" factor. All very simple, until it comes to cleaning up the instability which the extra leads can introduce. You must have a suitable layout, and in the ultimate, the broadened curve is

likely to be more asymmetrical than otherwise.

We weighed the pros. and cons. of all these schemes and then the idea struck us . . . why not switch out one IF transformer altogether? Resistance couple the converter, leaving the second transformer in place to drive the diode? The selectivity curve must be widened as a result, it must remain reasonably symmetrical and tuning will not be affected. Furthermore, all switching would be in the one coupling circuit, so that the chances of instability would not be greatly multiplied.

Of course, the gain would go down a lot, but it might still be sufficient to receive the locals, which is all we

(Continued on Page 27)

PARTS LIST

1 Chassis 12" x 9" x 3 1/2" (approx.)

1 2-Gang Tuning Condenser

(A.W.A., Stromberg "H")

1 Dial (USL 32 or similar)

1 Aerial Coil

1 Oscillator Coil

2 455 Kc. I.F. Transformers

1 Power Transformer 385-0-385

at 100 ma., 6.3v at 3a and 5v

at 2a.

1 100 ma. Choke

RESISTORS

1 2 meg.

1 1.5 meg.

3 1.0 meg.

1 .25 meg.

1 .1 meg.

4 .05 meg.

2 .02 meg.

1 5000 ohm 5 watt

1 2000 ohm

1 200 ohm

1 100 ohm

1 30 ohm 3 watt

2 .25 meg potentiometers

4 Octal Valve sockets

2 5-pin Valve sockets

CONDENSERS

2 16 mfd. 525 pv. (600 pref.)

2 10 mfd. 40 pv.

1 8 mfd. 525 pv.

1 .25 mfd. 600v paper

3 .1 mfd. 3 .05 mfd.

2 .01 mfd. 1 .005 mfd.

1 .001 mfd.

1 .00025 mfd.

1 .0004 mfd (or variable padder)

5 .0001 mfd.

1 .00005 mfd.

VALVES

1 ECH35, 1 EBF32, 1 6J7-G,

1 807, 1 5Y3-G/GT

SPEAKER

Permag. 3500 to 5000 ohm load.

SUNDRIES

Shielded Wire, hook up wire, 1 valve shield, knobs, resistor strips, solder lugs, grid clips, power flex, nuts and bolts, 2 terminals, 2 trimmer condensers, spaghetti insulation etc.

require of it. There was only one way to find out, so we modified a tuner to test the idea. Well, it worked! There was enough gain and selectivity to receive the stronger locals, which were the ones we wanted to hear under wide-range conditions.

Two of the weaker B-class stations were subject to some interference, and were not good listening for that reason. But they were there at full strength, with the receiver operating conventionally. That is just the whole point of the scheme; there is really nothing to lose by it, and a lot to gain.

Having proved the point, we were naturally keen to incorporate the circuit in a receiver. First choice fell on a standard five-valve job, which is the kind of set the average reader wants to build. Broadly speaking, too, it is the smallest type of set which can reasonably be adapted for wide-range reception. We decided, too, that the receiver should have something a little more ambitious in the way of audio channel, and this is basically the story behind the Radio and Hobbies "Fidelity Five."

THE CIRCUIT

Now for an examination of the circuit. For the converter and IF amplifier valves we elected to use an ECH35 and an EBF32 because of the slightly higher stage gain which they make possible. Any of the other standard converters would serve the purpose, with a 6G8-G as IF amplifier, but we had to select one type or the other and the matter of gain influenced our decision.

The tuning circuits of the receiver are quite conventional and you can use any brand of coils which you prefer. The gang condenser will normally be either an AWA or a Stromberg "H" type, and the dial should be purchased to suit in order to ensure correct tracking.

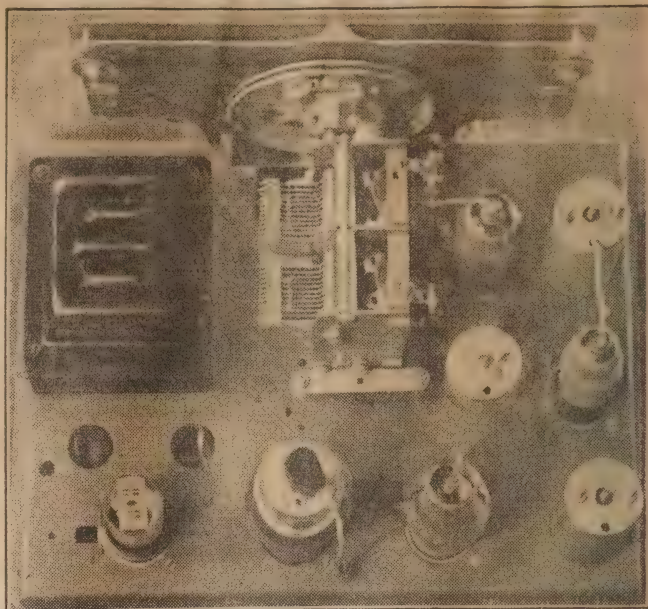
The cathodes of the first two valves are earthed, the necessary initial bias being picked up from a back-bias resistor. This scheme saves the five condensers and resistors which would be necessary if the two cathodes were to be biased separately in the interests of stability. A simple divider network supplies the two screens. This circuit calls for a 25,000 ohm two-watt resistor, but it may be replaced, if necessary, by two parallel-connected 50,000 ohm one-watt resistors.

SELECTIVITY CONTROL

The chief point of interest in the circuit centres, of course, around the coupling between the first two valves. In the normal way this is provided by a tuned IF transformer, which ensures high gain and selectivity.

In this circuit you will notice that a resistor is connected in series with the B-plus lead to the transformer, while there is another resistor in series with the AVC return. The B-

TOP-CHASSIS VIEW OF THE SET



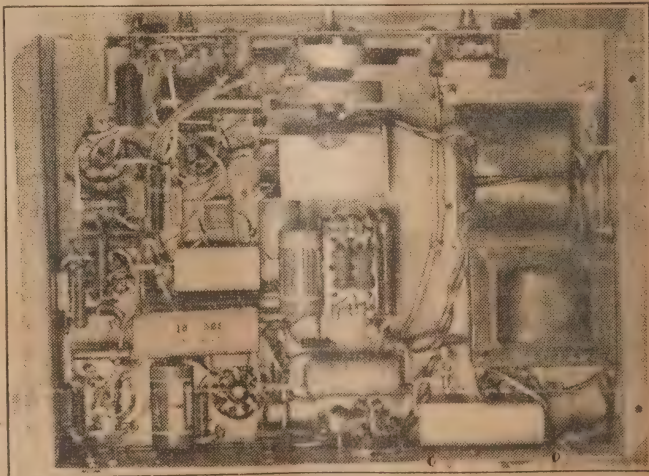
This picture shows placement of parts above the chassis.

plus and AVC lugs are bridged by a .0001 mfd mica condenser, and into this network is coupled the double-pole selectivity switch.

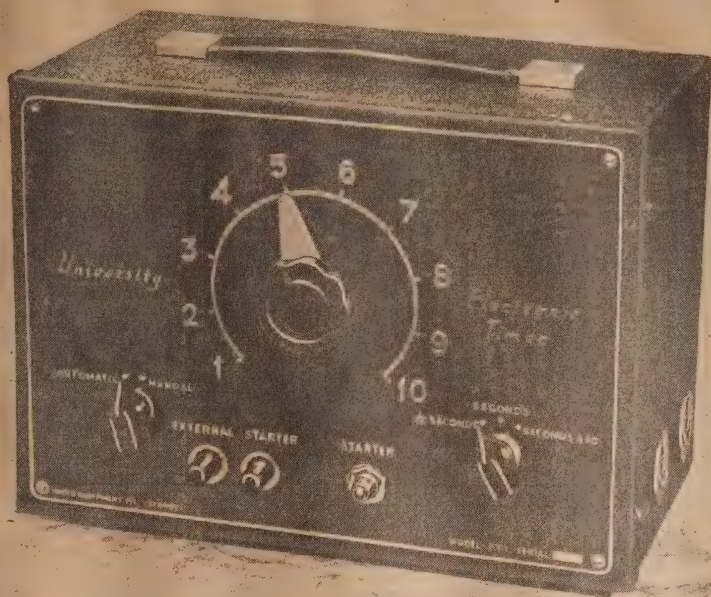
In one position of the switch the series resistor in the B-plus return is bypassed to earth, so that the transformer primary winding is effectively decoupled. At the same time the lower end of the secondary winding is bypassed to earth, the condenser and series resistor acting as an additional filter in the AVC line. The interstage coupling is therefore quite normal and the receiver has

the usual characteristics of selectivity and gain.

However, in the alternative position of the switch the contacts short out the respective IF transformer windings, leaving the 20,000 ohm resistor as the plate lead for the converter valve, and the 0.1 megohm resistor as the grid return for the following stage. The coupling between plate and grid is provided by the .0001 mfd condenser and by the stray capacitances across the IF transformer and wiring. The whole circuit is therefore exactly the same



The wiring and components underneath the chassis.



The New **ELECTRONIC TIMER**

This is a unique new "University" instrument with a number of applications for industry generally. Where any timing operation is required it will allow better service to be given and bring bigger returns. The instrument illustrated is one of a series and is A.C. operated. The range of these Electronic Timers can be supplied covering a wide variation of time intervals and in current carrying capacities.

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MODEL ET1: .1 of a second to 100 seconds in three ranges. First range: .1 of a second to 1 second in .1 second steps. Second range: 1 second to 10 seconds in one second steps. Third range: 10 seconds to 100 seconds in 10 second steps.

MODEL ET2: .1 of a second to 111 seconds. The range in this Model is continuously variable in .1 second steps. Thus any time interval between .1 of a second and 111 seconds is easily obtained. For example: a time of 87.3 seconds is as easy to obtain as a time of 15 seconds.

Other Models are available for longer time ranges. Details are available on application.

POWER SUPPLY: 190 to 260 volts A.C. at 40 to 60 cycles per second. Mains voltage variation has a negligible effect on instrument operation.

CONTROLS: In Model ET1, there is a central control marked 1-10, which allows the time interval to be chosen. A small switch selects the desired range, and a second small switch allows the instrument to be used as an automatic timer or a manually controlled timer. An easily operated starter switch is on the front panel and provision is made to external or remote switching. This remote switch control can be used up to relatively long distances. Twin outlets on the side of the instrument allow one or two machines or articles requiring control to be plugged straight in, thus obviating unnecessary wiring.

OPERATION: When a chosen time has been selected and the machine requiring control is plugged into the timer, the starter switch in the front is pressed. After the required time interval, the internal relay is operated, thus switching on or switching off the power as required. This internal relay carries up to 10 amperes at 240 volts, and may be used to either close or open the controlled circuit for the desired time interval. As normally supplied, the relay applies power mains voltage to the two outlets in parallel for the selected time interval. If the relay is required to remove the power mains voltage from the outlets for the time interval, or if it desired that the relay simultaneously apply voltage to one socket and remove it from the other, or if the outlet sockets and relay are required to be independent of the power mains so that the timer may control some other power source, please specify when ordering.

CASE SIZE: 11 $\frac{3}{4}$ " x 8 $\frac{1}{2}$ " x 7 $\frac{1}{2}$ " over controls.

FINISH: Black brocade case fitted with carrying handle. The panel is matt black with raised nickel-plated markings so that operation is convenient in a dark room.

GENERAL: The instrument is complete with all accessories—valves and instruction manual. It is carefully engineered and capable of continuous hard work.

IT'S A

University

INSTRUMENT

MANUFACTURED BY: RADIO EQUIPMENT PTY. LTD.

5 NORTH YORK STREET, SYDNEY, N.S.W. 'PHONES: B1960, B3678.

BARGAIN RELEASES



P.M.G.

Adjustable Morse Keys

We have made another purchase of these brand new, genuine P.M.G. Adjustable Morse Keys and we are now able to sell them at the ridiculously low price of 10/- each.

P.M.G. MORSE KEY **10/- ea**
(Without Headphones).

P.M.G. MORSE KEY With brand new Stromberg-Carlson headphones .. **19/6**

Postage 1/6 extra



REFLECTOR GUNSIGHTS

Ex-Air Force. Containing best quality condenser lenses and adjustable reflector. Parts can be used for many purposes.

39/6 ea.

Postage 2/6 extra.

COMPONENTS INCLUDE THESE VALUABLE LENSES.



No. 1 Diam. 3 5/8 Foc. Len. 10in.
No. 2. Diam. 3 1/2 Hbblow Ground. No. 3 Diam. 3 1/2 Foc. Length 4 1/2in. +
No. 4 Diam. 2 3/8 Foc. Length 6 1/2in.
+ No. 5 Diam. 1 1/8 No. 6 Diam 1 1/8 Amber Coloured ordinary.

TELESCOPES

Artillery Gun sights as used by the Army. 3 plus to 9 plus variable power. Ideal for general purposes, rifle clubs, etc. Length, 22in., diam. 2 1/2in., weight 10 1/2lbs. The definition and clearness of this scope is absolutely amazing. Original cost to the Army £65 each.

OUR PRICE .. **£10/10/-**

Freight, N.S.W., 7/6 In'state, 12/6



GREASE GUN

Push-type grease guns, ex-Army. 5oz. Slightly used; perfect order. 12/6 each. 10oz., slightly used; perfect order, 15/- each. 10oz. new. £1 each.

Postage 1/- extra.



Genuine P.M.G. Morse Key, with Light

Complete with Steel Carrying Box, 8in. x 8 1/2 x 7. Worth at least £6/10/-.
With carrying strap

Our Price .. 7/6 ea.

The Carrying Case, which is complete with shoulder strap, alone is worth the money, or together with spotlight 25/-.

Postage NSW 3/-; Interstate 5/6.

3/11



METAL TOOL BOX

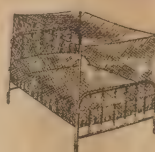
3/11 ea.

3 1/2 wide, 7in. deep, 15in. long. Ideal for carrying spanners, pliers, hammers, etc. Opens at top and has leather grip handle. Cost the Army 15/- each. Brand new. Out they go for 3/11 each. Post, N.S.W., 2/- extra; Interstate 3/6 extra.

Gent's renovated Pocket watches, nickel and rolled gold—7 and 15-jewels. Fully guaranteed. **£2/10/-**

PRICE **& £4/15/-**

Postage 1/- extra.



MOSQUITO

NETS

14/6

Ex-Army. Green. Brand New. Originally cost the Army 35/-.

OUT THEY GO .. **14/6**

Postage 2/- extra.



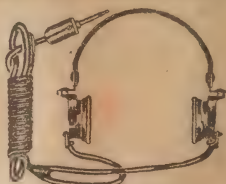
Spot Light

Ideal for fishing, hunting, shooting. Brand new. Original cost £2/15/-.

Our Price **17/6**

or together with Morse Key, Light and Case, 25/-.

Complete with Stand, Freight 3/-.



HEADPHONES

Brand new, S.T.C. and Stromberg-Carlson. We have just made another purchase of these brand new 'phones, complete with cord and plug, and we are now able to sell them at the ridiculously low figure — 130 ohms impedance .. **9/6**

Postage 1/6 extra.

2000 ohms impedance .. **£1**

Suitable for crystal sets.

PLEASE NOTE: These 'phones are brand new, ex-Army, and not military rejects.

Gent's renovated, latest style, 15-JEWEL WRIST WATCHES—Chrome and Steel Back—Fully Guaranteed.

PRICE .. **£4/15/-**

Postage 1/- extra.



No C.O.D.

DEITCH BROS.

210a GEORGE ST., SYDNEY

SUPER TOOL OFFER

BEST QUALITY SPANNERS

ONE-WHIT SPANNER

1 Whit. Spanner 1-8 x 3-16
1 Whit. Spanner 3-16 x 1/4
1 Whit. Spanner 1/4 x 5-16
1 Whit. Spanner 5-16 x 3-8
1 Whit. Spanner 3-8 x 1/2
1 Whit. Spanner 1/2 x 7-16
1 Whit. Spanner 5-8 x 1/2

MAGNETO SPANNERS

1 Magneto, 6 BA x 6 BA
1 Magneto, 2 BA x 4 BA
1 Magneto, 11-32 x 3-8

With 1 small Hand Vyce and 1 Tool Box, 3 3/4 x 7in. deep, 15in. long.

PRICE, with Steel Spanners .. **£1/18/9**

PRICE, with Van Chrome Spanners .. **£2/6/3**

Or both lots of Spanners in Van Chrome with three Mag. Spanners, Tool Box and Vyce.

THE LOT, ONLY

VAN CHROME ONLY

1 S.A.E. Spanner, 5-16 x 13-32
1 S.A.E. Spanner, 3-8 x 7-16
1 S.A.E. Spanner, 7-16 x 1/2
1 S.A.E. Spanner, 11-16 x 19-32
1 S.A.E. Spanner, 1/2 x 9-16
1 S.A.E. Spanner, 9-16 x 5-8
1 S.A.E. Spanner, 5-8 x 3/4

Complete with 1 Magneto Spanner, 6 BA x 6 BA; 1 Magneto Spanner, 2 BA x 4 BA; 1 Magneto Spanner, 11-32 x 3-8; 1 small Hand Vyce, 1 Tool Box, 3 3/4 x 7in. deep x 15in. long. THE **£2/5/9**

LOT FOR .. **£3/15/-**

"FIDELITY FIVE"

At very low volume it tends to preserve a sense of brilliance, which is just the opposite effect to that achieved in the average five-valve set. You can omit or include the

TRANSFORMER RANGE by FERGUSON

This list of FERGUSON TRANSFORMERS represents our standard range which we are at present supplying the Radio trade.

This is by no means our complete range when taking into account those Transformers being supplied to manufacturers' special requirements.

Transformers of this type cannot possibly be listed in the space available and manufacturers are requested to contact us direct regarding their special Transformer requirements.

STANDARD RANGE TYPES

OUTPUT TRANSFORMERS

TYPE	PRIMARY	SECONDARY	RATING	TYPE	PRIMARY	SECONDARY	RATING
OP1	5000 and 2500 ohms S.E. Coil	12.5, 8.0 & 2.3 ohms Voice	10W	OP18	3800 ohms P-P	500, 250 and 125 ohms	60W
OP1A	5000 and 2500 ohms S.E. Coil	12.5, 8.0 & 2.3 ohms Voice	10W	OP19A	5000 ohms P-P (30-10,000 C/s)	12.5, 8.0, 2.3 ohms Voice	15W
OP2	5000 ohms P-P	12.5, 8.0 & 2.3 ohms Voice	15W	OP19B	5000 ohms P-P (30-10,000 C/s)	500, 250 and 125 ohms	15W
OP3	6600 ohms P-P	12.5, 8.0 & 2.3 ohms Voice	15W	OP20	11,600, 8400 ohms P-P (F.A. Range)	500, 250, 166 & 125 ohms	150W
OP4	10,000 ohms P-P	12.5, 8.0 & 2.3 ohms Voice	15W	OP21	8000 ohms P-P (30-15,000 C/s)	500/125 ohms	15W
OP5	5000, 6600, 10,000 ohms P-P	12.5, 8.0 & 2.3 ohms Voice	15W	OP22	3250 ohms S.E. 85 M.A. (30-15,000 C/s)	2.3 or 500/125 ohms	10W
OP6	5000 ohms P-P	500, 250 and 125 ohms	15W	OP23	3250 ohms S.E. 85 M.A. (30-15,000 C/s)	12.5 or 8.4/2.1 ohms	10W
OP7	6600 ohms P-P	500, 250 and 125 ohms	15W	OP25	10,000 ohms P-P (20-30,000 C/s)	Any Two Impedances in 4 to 1 ratio e.g. OP25 500/125. OP25 8.4/2.1	15W
OP8	10,000 ohms P-P	500, 250 and 125 ohms	15W	OP25M	10,000 ohms P-P	500 ohm Line 10 Tappings	15W
OP9	5000, 6600, 10,000 ohms P-P	500, 250 and 125 ohms	15W	OP15M	6600 ohms P-P	500 ohm Line 10 Tappings	15W
OP10	5000 ohms P-P	500, 250 and 125 ohms	25W	LI	500 ohms	12.5, 8.0, 2.3 ohms	10W
OP11	6600 ohms P-P	500, 250 and 125 ohms	25W	U1	30,000, 20,000, 14,000	2.3 ohms Voice Coil	10W
OP12	10,000 ohms P-P	500, 250 and 125 ohms	25W		10,000, 7000, 5000	2500 ohms P-P-R S.E. Universal Speakers.	
OP13	5000, 6600, 10,000 ohms P-P	500, 250 and 125 ohms	25W				
OP14	5000 ohms P-P	500, 250 and 125 ohms	32W				
OP15	6600 ohms P-P	500, 250 and 125 ohms	32W				
OP16	10,000 ohms P-P	500, 250 and 125 ohms	32W				
OP17	5000, 6600, 10,000 ohms P-P	500, 250 and 125 ohms	32W				

CLASS B DRIVER AND INTERSTAGE TRANSFORMERS

	PRIMARY	SECONDARY	RATING		PRIMARY	SECONDARY	RATING
IP1	Single 6J7G Triode	Class A1, AB1, P-P Grids	1	IP3	P.P. Class A, A1 Triodes 45's, 2A3's, etc.	Class B P.P. Grids	2, 3 or 4
IP2	Single 6V6 Triode	Class AB2 P.P. Grids	2.5	IP4	S.E. or P.P. Triodes	Class B P.P. Grids	2.8 or 2.15
	40 M.A. D.C. Unbalance	807, etc.				809, 830B, etc.	

MODULATION TRANSFORMERS

	PRIMARY	SECONDARY	RATING		PRIMARY	SECONDARY	RATING
M25	6000 & 8000 ohms P-P	10,000, 7000, 5000 ohms, 100 M.H.	25W	M50M	Multi Primary	Multi Secondary	50W
M50	3800, 6600, 8000 ohms P-P	10,000, 7500, 6500, 5500, 4500, 3500 ohms 150 M.A.	50W	M125M	Multi Primary	Multi Secondary	125W

VIBRATOR TRANSFORMERS

6V/150	6V at 0.9A D.C.	150V at 25 M.A.	6V/250	6V at 3.4A D.C.	250V at 60 M.A.
6V/200	6V at 2.9A D.C.	200V at 50 M.A.	6V/240/U	6V at 3.9A D.C. or 240V A.C.	250V at 60 M.A. 6.3V at 2A (A.C.), using 6X5GT Non Sync. Operation.

POWER TRANSFORMERS

P30	240V A.C.	150V/150V at 30 M.A. 6.3V at 2A.
-----	-----------	----------------------------------

FILTER CHOKES

C30/25	30 Henries at 10V A.C. 100 C/s + 25 M.A. D.C.
C12/200	12 Henries at 10V A.C. 100 C/s + 200 M.A. D.C.

LABORATORY SERVICE TO MANUFACTURERS

The Ferguson Laboratory is continually engaged in research for the improvement and advancement in the transformer and electronic field. This Laboratory together with its technical staff is available to assist manufacturers with their transformer problems.

FERGUSONS RADIO Pty. Ltd.

12 McMAHON STREET, WILLOUGHBY

Procurable from any wholesale house in all States including Tasmania. If you have any trouble obtaining supplies, write to us direct and we will forward a list of suppliers.

Factory Representative:

N.S.W.: ELECTRONIC INDUSTRIES IMPORTS.
VIC.: ELECTRONIC INDUSTRIES IMPORTS.

QLD.: ELECTRONIC INDUSTRIES IMPORTS.
Sth. AUS.: APEX AGENCIES.

condenser, if you desire, but remember that the whole purpose of this set is to bring in the treble register as it should be heard.

Last, but not least, comes the output stage, which provides some food for thought. Frankly, we were hard put to it to decide between an 807 and the more usual 6V6-G for this position. Thanks to war surplus, the 807 is slightly cheaper and, of course, can be made to give higher power output. Actually, the 6V6-G will make plenty of noise for the average home, but one idea of a high quality set is to have a reserve of power so that the circuits will not so easily overload on loud passages or on heavy bass.

But there is no point in using an 807 valve if the power transformer is to be of the 285 volt, 80 ma. variety, thus drastically limiting the high tension supply available for the output valve. One may just as well use the conventional 6V6-G.

TRANSFORMERS

The next step up in transformers is the 385 volt 100 ma. type. Unfortunately, with a conventional filter and a permagnetic speaker, this gives too high a voltage for simple class A conditions, even with an 807. Another point is that the valve requires, for these conditions, a 2500 ohm output transformer capable of carrying the best part of 80 milliamps.

Ultimately we reverted to the scheme used in the recently described recording amplifier, using the 807 with high plate voltage, about 250 volts on the screen, and bias sufficient to limit the plate current to a convenient figure.

The high voltage from the transformer is thus usefully employed, while the dropping resistor to the screen and B-plus supply line allows some resistance-capacity filtering to be obtained. For this reason the "Fidelity Five" has only one filter choke, instead of two, as in the 1947 "Advance." Lastly, the 807 will operate happily into a higher load, under these conditions, and anything from about 3500 to 5000 ohms will suffice.

POWER OUTPUT

The exact power output depends on the way the voltages work out in individual receivers, but you can expect from 7 to 12 watts, to quote the likely extremes.

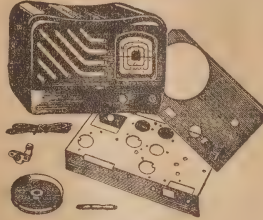
Resistors are connected in series with the screen and grid leads as a precaution against instability with this very high gain valve. They should be mounted right at the base pins to be fully effective. Bring the plate lead straight down through the chassis to the speaker plug and avoid having any wiring connected to it wandering aimlessly around the chassis—inside or out.

A simple negative feedback network is connected between the plate of the 807 and the plate of the 6J7-G. This involves a resistor and a series condenser, the latter limiting the feedback at the very low frequencies and providing a degree of bass lift.

For 30 years specialists to Radio Amateurs

Homecrafts

EVERYTHING FOR THE SET BUILDER



Bakelite Mantel Cabinets—Complete with 5 Valve Steel Chassis, Baffle Plate and Dial Assembly, as illustrated.
ONLY 45/-



PORTABLE CABINET

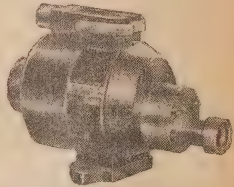
To suit up to a 5 valve Portable. Leatherette covered, as illustrated.

50/-



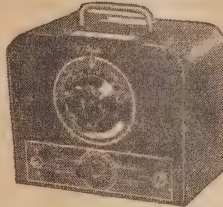
Combination Cabinet

Walnut Piano finish, Combination Cabinets, as illustrated.
19 gns.
Country Clients add 15/- freight.



DISPOSAL BARGAINS

Small Aircraft Generators, 12 Volt, 15/11 Will work as 12v. Motor—As illustrated.



Pioneer Test Oscillator, will cover all bands. As illustrated. £7/19/6 complete.

HOME BROADCASTER

Homebroadcaster Microphone. Adds fun to a party. 7/11
Works with any Radio Set.



SPECIAL BARGAINS

Type 815 Imported Transmitting Tubes, Plus sales tax £2
Fixed Type Crystal Detectors 2/11
Low Tone Buzzers 2/11

SPECIAL — CHASSIS BARGAIN

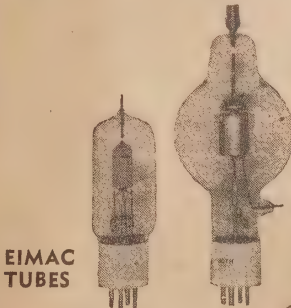
Large steel Chassis, measuring 14 1/2 x 9 x 2 1/2. Suitable for up to a 7-valve set. 6/11.

Electrolytic Condensers, 200mfd. 12v. 24mfd. 150v. 4mfd. 350v. 1/3

Speaker Transformers, 7000, 9000 or 12,000 ohm. To voice coil 6/11

New Aegus Kit Set available for Immed. Delivery, P.P.4 Personal Portable Comp. Kit including Batteries and Valves.

ONLY £16/17/6



EIMAC TUBES

EIMAC TUBES — Complete range of the famous imported American Transmitting Tubes. Available for immediate delivery. Range includes:

25T	£3/11/-	35TG	£4/12/6
RX21	£4/9/-	KY21	£5/17/-
35T	£3/19/-	100TH	£8/4/10
		250TH	£13/3/-

290 LONSDALE STREET, MELBOURNE, C4311.

Head Office: MELBOURNE, 290 Lonsdale-street, and at 211 Swanston-street, Melbourne; 135 Moorabool-street, Geelong; 307 Sturt-street, Ballarat. 100 Clarence-street, SYDNEY. 26 Hunter-street, Newcastle, Hobart, Launceston and Burnie, TASMANIA.

HERE NOW! The lowest priced high quality crystal mike in Australia

Another **ACOS** triumph!

Ideal for hams. The "J7" gives crisp, clear cut, "DX quality" reproduction, to cut through the heaviest QRM. High frequencies peaked—high output—has built in load resistor.

Public Address. Its excellent quality and high output makes the "J7" suitable for all P.A. installations—light and rugged—easily adapted for use as lapel mike.

Home Broadcasting. Because of its exceptionally high gain, the "J7" will give ample volume when plugged direct into the pick-up terminals of most good receivers. No preamplifiers or transformers required—a novice can install it.

Office and Factory Call Systems. With its accentuated "speech range," the "J7" is ideal for all paging systems.

Hearing Aids. Sensitive—light—rugged. Incorporated in leading British Deaf Aid equipment.



ACOS—J7 Crystal Microphone Insert

Size: 1-11/16" x 5/16"

Described in this issue

Sole Australian
Distributors

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(Australasia)
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**OBTAINABLE FROM
ALL GOOD STORES**

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COMPONENTS



IRON CORED SHORT WAVE COILS

Iron Cored Short Wave Coils:
I.C.62 aerial, I.C.63 R.F., I.C.
64 Oscillator, 13 to 42 metres
for use on Standard H gang.

PRICE 4/9

455 KC STANDARD PERMATUNED I.F. TRANS- FORMER

in aluminium can. First
stage PT. 31, Second Stage
PT 32.

PRICE 13/9



P12. STANDARD 5-PLATE Padder CONDENSER:



455 KC, using Polystyrene
base. For use in con-
junction with H gang
condenser.

PRICE 2/6

R.F. CHOKES

R.F. Choke. Standard general
purpose honeycomb winding
will carry up to 50 M/A.

PRICE 1/10



AIR CORED S/W COILS

Air Cored S/W coils. 13 to 42
metres, Z.C. 59 Aerial, Z.C. 60
R.F., Z.C. 61 Oscillator. For
use with H gang . . .

PRICE 2/10



M.E.B. TRIMMER CONDENSER

M.E.B. Trimmer Condensers: 2
to 35 MMFD on Polystyrene
base.

PRICE 1/1



DP 3A TUNING UNIT, 3 stage, range 13 to 42
metres, 1600 to 550 KC. PRICE, £4/17/0.

B.F.O. 455 KC OSCILLATOR COILS. PRICE 12/- ea.

R.F. COIL with reaction, in aluminium can. Price 9/10.
Reinartz Coil, in aluminium can. PRICE, 7/6.

D.C. 2A TUNING UNIT, 13 to 42 metres, 1600 to
550 KC. PRICE, 36/-.

Crown
RADIO PRODUCTS PTY. LTD.
51-53 MURRAY STREET
PYRMONT — SYDNEY
Telephone MW2628
(2 Lines)

THE FIDELITY FIVE

As already mentioned, the details of the power supply are more or less fixed by the requirements of the 807 output valve. A single section filter is included in the 807 plate supply but the dropping resistor and bypass condenser in the screen supply constitute an additional section for this portion of the circuit.

Any hum in the plate circuit of the 807 is liable to be fed back via the negative feedback network circuit and it is therefore important to have the filter circuit functioning properly. It is essential to use 16 mfd. condensers either side of the choke, which should itself have as high inductance as possible. Save yourself any bother on this score by insisting on the best available type. Tubular 16 mfd. condensers are available in limited quantities, although you can go one better by using two parallel-connected 8 mfd. 600 volt units instead.

ALIGNMENT

The alignment procedure for the receiver is perfectly normal. Set it to the full selectivity position and do all the usual things. The procedure has been set out in connection with many receivers, but we can, if necessary, supply a set of alignment instructions through the shilling query service.

When you switch to the broad position, you will notice the gain drop back appreciably on the weaker stations and, in fact, under adverse conditions, you may have to use the normal setting to receive certain stations. However, the use of a fairly good aerial will allow the AVC to smooth out variations in gain more effectively.

NORMAL TUNING

You can tune the receiver normally in the broad position but don't be misled if it sounds higher pitched when you simply switch back to maximum selectivity. The tuning is then much sharper and you will probably be on one or other of the sidebands. To make a comparison, always tune the receiver in the sharp position before switching back and forth from one setting to the other.

Lastly, a word about the programmes you will hear. Most stations appear to use a fairly substantial treble cut on records, thereby minimising noise without altering the quality of signal from the average receiver. The difference between the broad and sharp positions on much recorded music is therefore not startling.

DIRECT BROADCAST

But the real test is on direct broadcasts of either music or plays. Many transcriptions, too, are excellent, if the operator remembers to take out the scratch filter. And your favorite announcer's voice will suddenly take on a new character as you remove the electrical cotton wool from his mouth.

There's an interesting story to tell . . .

ABOUT THE NEW

ACOS G.P.10 CRYSTAL PICK-UP



THE PICK-UP

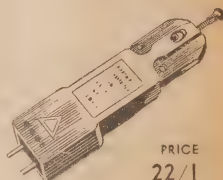
A modern, high fidelity, crystal pick-up housing the G.P.9 cartridge in a smart, moulded bakelite arm. Needle pressure can be adjusted from novel beryllium copper spring in the base and bracket assembly to user's preference. Normal pressure is only $1\frac{1}{4}$ oz. Other features include 95 degree lift back for needle changing, and vibration-free arm movement.

PRICE

48/6

THE G.P.9 CRYSTAL CARTRIDGE

The G.P.9 is unique amongst crystal cartridges in that it is virtually impossible to break the crystal contained therein. Other advantages include freedom from effects of humidity, low record wear, resonance free reproduction, etc.



PRICE
22/1

... housing a unique assembly making crystal virtually UNBREAKABLE!

The motion of the stylus is passed to the crystal via a flexible coupling. This means that, whilst the lateral movements caused by the record grooves are effectively transferred, the flexible coupling A absorbs sudden vertical movements caused when pick-up is dropped on record—thus protecting the crystal B—making it virtually unbreakable.



A NEWLY IMPORTED FAVOURITE—

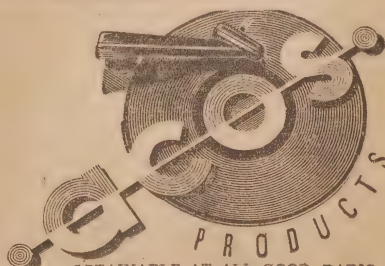
THE G.P.6 MAGNETIC PICK-UP



Designed to conform with modern standards the G.P.6 is an attractive moving iron magnetic pick-up. Moving parts are small—reducing needle impedance, improving fidelity, reducing record wear. Other features include: Adjustable needle pressure—normally 2oz. High permeability Ticonal magnet.

Price

£2/4/1



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AMPLION FOR
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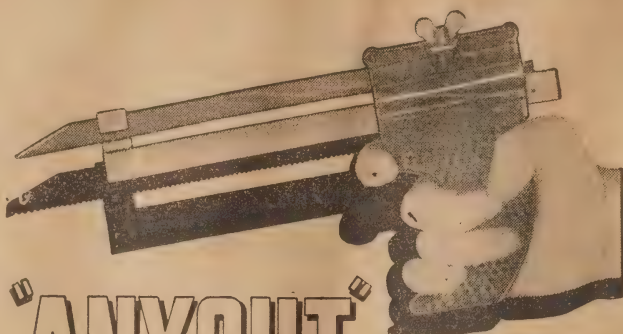
ONE IN EVERY HOME AND WORKSHOP

A VAUXHALL PRODUCT

Obtainable at
all leading
Hardware
Stores
and all
Country
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Ask your Local
Storekeeper.

AGENTS
WANTED



ANYCUT SAW

CUTS TO
ANY DEPTH

USES ANY
SIZE BLADE

CUTS AT
ANY ANGLE

NO MORE
BROKEN
BLADES

NO SKILL
REQUIRED

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MULLARD SUB-MINIATURE VALVES

Mullard's announcement of the development of new Sub-Miniature Valves represents a marked advance in Deaf-Aid manufacturing technique. It opens up possibilities in all kinds of electronic design applications and deaf-aid equipment when size is a limiting factor. The valves are 10 m.m. (approx. 2-5 inch) in diameter; lengths are: type DF70—30 m.m. (approx. 1 1-5 inch) and DL71 and DL72 output pentodes, 38 m.m. (approx. 1 1/2 inch). Three DF70 valves will fit comfortably in a teaspoon.

It is interesting to note that Mullard Sub-Miniature Valves have contributed largely to the successful development of an All-British Hearing Aid which will be available to all afflicted persons under the new British National Health Service Act. Nearly 1/2 million Mullard sub-miniatures will be supplied as standard equipment. The electrode structure is built

up from a flat glass disc in a manner basically similar to that employed in the well-known all-glass technique which has been perfected in the Mullard laboratories. This method of construction enables a high degree of rigidity and consequently freedom from microphony. The lead-out wires are tinned to facilitate soldered connections into the circuit.

Reference to the data shown reveals that the filament current ratings of the Mullard Sub-Miniature Valves are extremely low. This advance will be apparent when it is considered that the normal 3-stage amplifier in a hearing-aid consumes a total filament current of only 50 mA, representing a considerable saving in battery consumption.



Mullard

Mullard - Australia Pty. Ltd., 35-43 Clarence Street, Sydney

PRINCIPAL CHARACTERISTICS

	DL71	DL72	DF70
Filament Voltage	1.25 v.	1.25 v.	0.625 v.
Filament Current	25 mA	25 mA	25 mA
Plate Voltage	45 v.	45 v.	30 v.
Screen Voltage	45 v.	45 v.	30 v.
Plate Current	0.6 mA	1.25 mA	0.15 mA
Power Output	6 mW	23 mW	—

further details available on request.

A CRYSTAL MIKE FOR 30 SHILLINGS

A crystal microphone is one device most amateurs aspire to own because of its speech clarity and its convenience of application. Here's how you can acquire one for your station for less than thirty shillings.

THE usual crystal microphone costs several pounds — enough to represent a major investment for most amateurs. That is undoubtedly the reason why most make do with carbon types or improvised dynamics. The thought of a crystal microphone for between 25/- and 30/- will be something to quicken the interest of any such amateur.

We were talking about pickups, a few days ago, with a sales representative, when he mentioned casually that his firm had imported a large number of crystal microphone capsules, intended primarily for use in deaf-aid equipment.

The response frequency curve did not look particularly promising, exhibiting a pronounced peak in the vicinity of 3000-4000 cycles.

DEAF-AID UNIT

However, we duly got hold of one of the units and coupled it to an amplifier for tests. The speech was crisp and high pitched but certainly not metallic in quality as we had rather expected. In fact, it resembled very closely the quality we have come to expect from standard commercial speech-type crystal microphones.

The microphone capsule is about 3-8in. thick and 1½in. in diameter, and we found an old-time metal ear-phone case which seemed almost to be made for the job. A scrap of soft rag at the back was all that was necessary to keep the capsule forward against the front grille. This latter item was made, by the way, from a small piece of perforated copper which happened to be available.

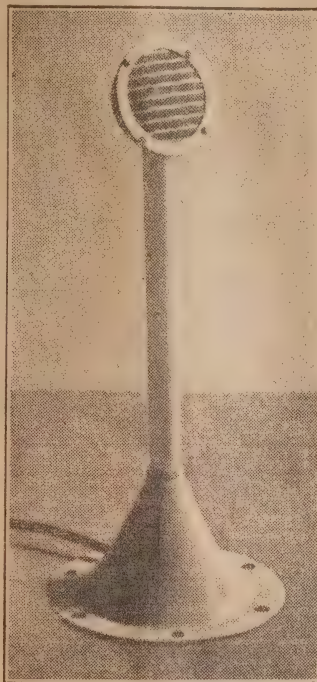
These days there are all kinds of snail covers on "this and that" in Disposals equipment, or you may be an artist with tin snips and solder. The main thing is to get a smooth surface on your creation—a coat of paint will do the rest.

The upright part of the stand is simply a length of brass-sheathed pipe, about ¼in. outside diameter, which was recessed at the top to carry the head with a slight backward tilt. Clean the metal and, with a hot iron over the gas flame, flow solder to round out the joint. Clean up with a file and emery paper.

For the base we used a conical rubber aerial mount which was a standard fitment to certain military transceivers. They are harder to get nowadays, but we have seen plenty of them in the past on the sixpenny junk counter. Drill a hole down the centre of the brass ferrule

to receive the cable, and then solder the upright to the brass ferrule atop the conical rubber stand.

If you can't get the same device to serve as a base, it is possible to use the frame from a discarded



The microphone stand and case may be built up from odds and ends in your junk box.

midget loudspeaker, or merely to mount the upright vertically on a round wooden disc. Please yourself about the exact dimensions and details.

The microphone capsule should then be installed in the case with wires running down the hollow tube to the base. One wire should be bonded to the metal parts of the microphone stand and then connected to the braiding of a shielded microphone cable. Ordinary shielded wire will do, and the exact length is unimportant. The other lead from the capsule, of course, connects to the inner conductor and goes ultimately to the "hot" side of the input circuit.

After that, a coat of paint will finish the job.

A crystal microphone usually operates best into a high load impedance, of the order of 5 megohms. These capsules actually have a 5 megohm resistor built into the case. It is wise, therefore, to inspect the input circuit of the preamplifier and, if necessary, replace the grid return resistor with one of 5 or even 10 megohms. Normally a low-gain preamplifier will be ample ahead of most modulator and amplifiers.

Under close-talking conditions, the microphone can be operated straight into the pickup terminals of a sensitive amplifier, or a receiver with a high-gain audio system. The chief problem is that the load will be provided by the volume control and will not normally exceed 1.0 megohm. Bass response, under these conditions, will be somewhat diminished.

Although we have envisaged the microphone mainly for amateur station work, it has obvious application in call systems, office communication, small-scale PA and, of course, the original application of hearing aids.

But the main point is that you can buy it out of one week's wages!

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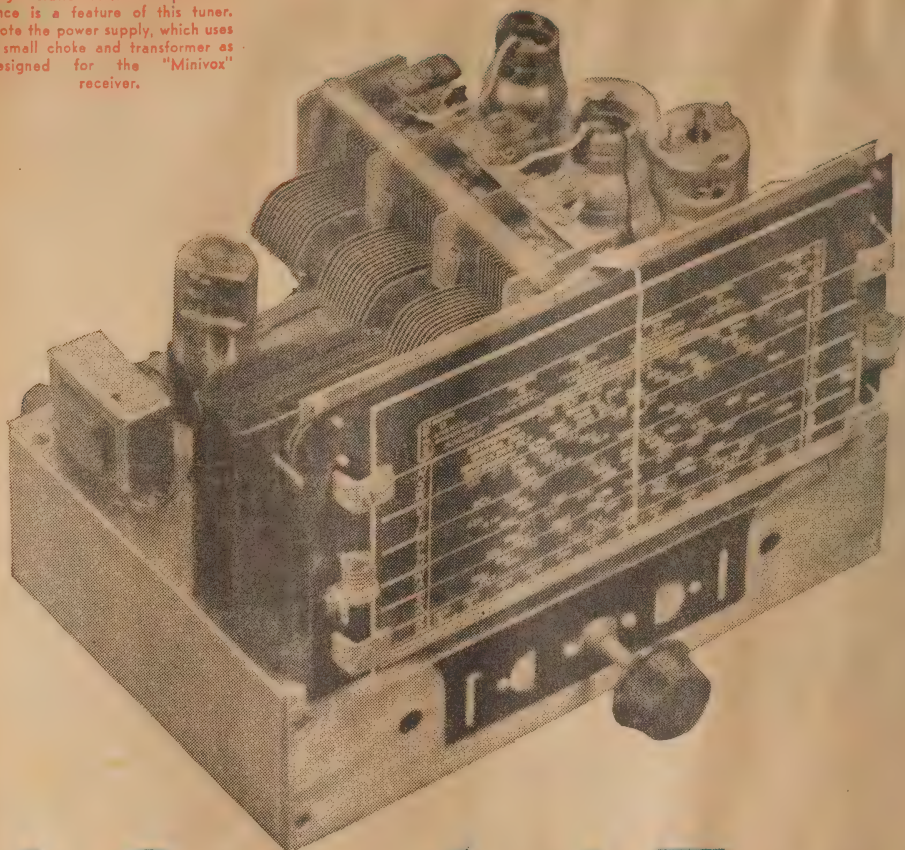
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High station-to-station performance is a feature of this tuner. Note the power supply, which uses a small choke and transformer as designed for the "Minivox" receiver.



A Superhet Tuner

Here is No. 4 in our series of radio tuners—a fully developed superhet circuit with built-in power supply. It will tune any signal on the broadcast band worth listening to and is therefore an excellent choice for the DX enthusiast or the country listener.

LAST month we told at some length the story of TRF tuners, and how they can ensure excellent reproduction from local stations. It should not be inferred from this that a superhet tuner is necessarily a generator of distortion and of barely intelligible signals. On the contrary, the vast majority of domestic receivers incorporate a superhet tuner, and they are seldom called into question by their owners from a fidelity point of view. The programmes are fully enjoyable, even though discerning listeners may notice a slight lack on

"presence" in the voice and a lack of brilliance in orchestral music.

Against that, a good superhet tuner will bring you a much wider variety of stations, and you may prefer this feature. Then, of course, there are the listeners in difficult reception areas, where gain or a high degree of selectivity is of paramount importance. More than this we cannot say. The choice of one type of tuner or the other remains one for the individual.

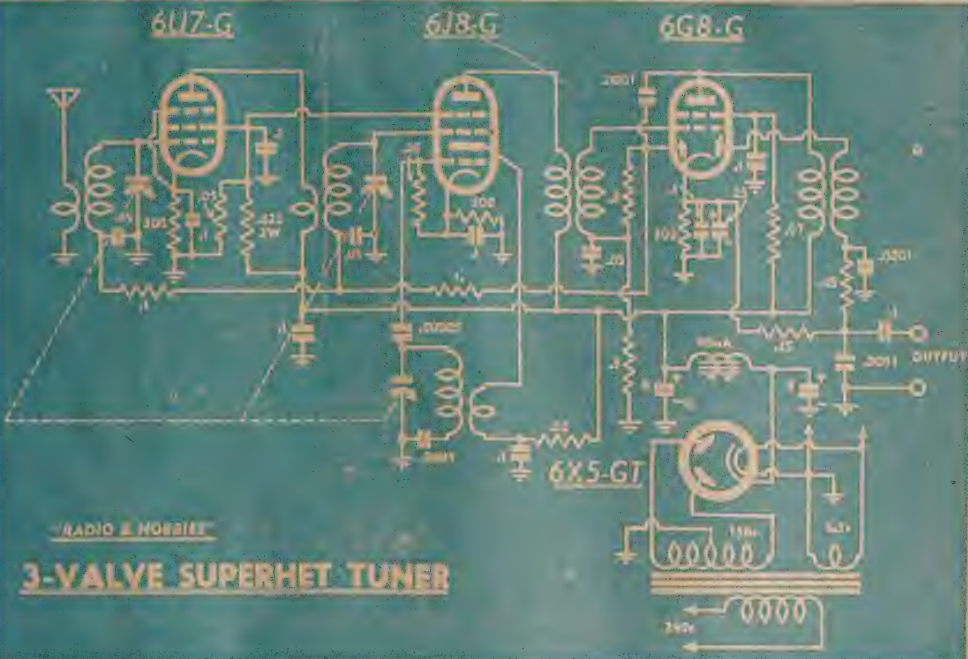
This new tuner is built on to the same chassis as was used for the TRF units, but the increased number of components necessitates rearrange-

ment of the layout. Quite apart from the power supply, the additional complexity is obvious from the underneath photograph. High gain, high selectivity and good AVC action is obtained at the expense of more components.

Reviewing the layout, the aerial coil mounts above the chassis just near the aerial terminal, and the 6U7-G RF amplifier valve is between the coil and rear section of the tuning-gang.

There is, obviously, not room on top of the chassis for all major components, so the RF coil and oscillator coil are mounted side by side on an angle bracket beneath the tuning-gang. These coils are tuned respectively by the centre and front sections of the gang, the grid leads passing straight down through the chassis to the "grid" lugs.

NEW CIRCUIT HAS BUILT-IN POWER SUPPLY



This tuner will log any broadcast station with a signal above the prevailing noise level. The circuit would serve equally well for a dual-wave tuner if suitable coil kit were employed.

The converter valve mounts alongside the centre section of the gang, the IF amplifier in front of it again, with the two IF transformers side by side on the outer edge of the chassis.

As in the case of the TRF tuners, a trimmer must be connected across each of the tuned circuits and the simplest way is probably to attach them to the top of the gang. In the AWA gang, there is a handy 1-8in. hole on the stator supporting bar and a nut, bolt and solder lug provide handy earth points for the trimmer on each section. Make sure, by the way, to earth the lug on the trimmer, which is common to the top plate and adjusting screw. The lower plate should be connected to the stator sections of the gang.

THE CIRCUIT

The electrical circuit follows standard superhet practice, except for a couple of small points which warrant special mention. Thus, the operating conditions of the 6U7-G and 6J8-G are quite normal as far as bias, screen supply and plate feed is concerned.

The screen potential for the first two valves is derived from a series network of resistors designed to place approximately 100 volts on the first two screens under no signal conditions and with a 250 volts supply. Note that the 25,000 ohm resistor

should be a 2-watt type, or, alternatively, made up of two 50,000 ohm 1-watt resistors connected in parallel. This series arrangement serves to keep the screen voltage fairly constant, and does not impose as much load on the power supply as would a normal voltage divider.

Separate bias resistors are suggested for all valves simply as a precaution against possible instability. One can often get away with a common resistor and bypass for two or three stages, but instability will re-

sult in some cases from this economy. We have rather assumed that the constructor of a large superhet tuner will not quibble at the inclusion of a few extra wiring parts.

There is also an impressive number of components around the 6G8-C but it must be remembered that this valve serves as IF amplifier, diode detector and AVC generator. For this same reason, you will note that there are both audio and RF bypasses in the cathode circuit.

One small point about the AVC

PARTS LIST

- 1 Chassis 10" x $6\frac{1}{2}$ " x 2 $\frac{3}{4}$ " (and coil mounting bracket).
- 1 3-gang tuning condenser.
- 1 Tuning dial to suit (Efco USL 32, or similar).
- 1 Power transformer 150-CT-150V at 30mA. 6.3V at 2 amps.
- 1 Filter choke 30mA (or higher).
- 1 Aerial coil.
- 1 R.F. coil.
- 1 Oscillator coil.
- 2 455kc. I.F. transformers.
- 3 Valve shields.
- 4 Terminals.
- 3 Trimmers.
- 4 Octal valve sockets.
- 2 Resistor strips.

RESISTORS:

- 2 0.5 meg., 1 0.25 meg., 1 0.1 meg.,
1 0.07 meg., 5 0.05 meg., 1 0.02
meg., 3 300 ohm.

CONDENSERS:

- 1 25 mfd electro., 2 8 mfd electro.,
8 0.1 mfd paper, 3 0.1 mfd paper.
3 0.05 mfd paper, 3 0.0001 mfd mica,
1 0.0004 mfd mica, 1 0.00005 mfd mica.

VALVES:

- 1 6U7-G, 1 6J8-G, 1 6G8-G, 1 6X5-
GT.

SUNDRIES:

- Knob, nuts and bolts, hook-up wire,
spaghetti power flex, 3 small grid clips.
2 dial lamps, solder lugs, 2 insulated
washers.

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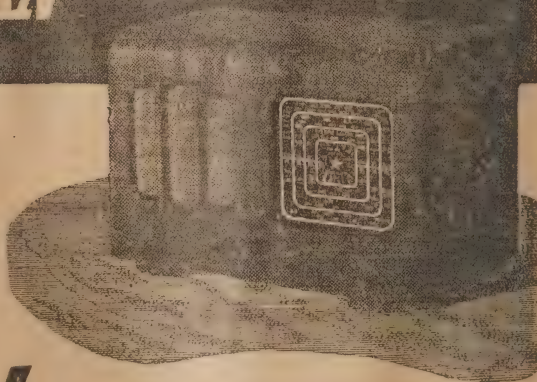
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system is worthy of note, viz., the reduction in the amount of AVC voltage applied to the 6G8-G grid. For reasons of stability, it is always wise to decouple this grid circuit separately, which involves one resistor and one condenser. By splitting the AVC diode load into two 0.5 meg. resistors it is possible to achieve this decoupling and, at the same time, reduce the amount of bias applied to the IF amplifier valve. This variation makes no appreciable difference to the AVC characteristic of the tuner, but the reduction in applied bias, together with the series screen feed to the 6G8-G, ensures that this valve handles high-amplitude signals to best advantage.

ALTERNATIVE VALVES

The choice of valves should present no difficulty from the supply point of view, although substitutes are possible. Thus the 6U7-G may be replaced without radical change by valves like 58, 6D6, 6K7G, 6SK7, etc. The 6J8-G could be replaced directly with the 6A8-G or by any other of the ordinary converter valves with appropriate minor changes to the operating conditions. The only replacements for the 6G8-G are the 6B7S or the EBF32.

Power supply requirements for the tuner are nominally 250 volts at approximately 20 milliamps, varying of course, with the nature of the input signal. Actually the tuner will operate quite satisfactorily from any supply voltage between about 150 and 300 volts and, unless one is particularly fussy about operating conditions, no change need be made to the screen and oscillator anode resistors.

The tuner could derive its supply from the associated amplifier, exactly as suggested for the TRF tuners already described.

The only complication likely to arise is low frequency motor-boating due to feedback through the power supply. This is most likely to occur if the main amplifier has very high gain at low frequencies, as with a preamplifier or tone control stage. Should this trouble occur it can often be cured by by-passing one or more of the screens to chassis with an 8 mfd condenser or the B-plus connection on the oscillator coil. If the worst comes to the worst and these measures do not effect a cure, a separate resistance filter system may have to be installed, feeding from the filament pin of the rectifier.

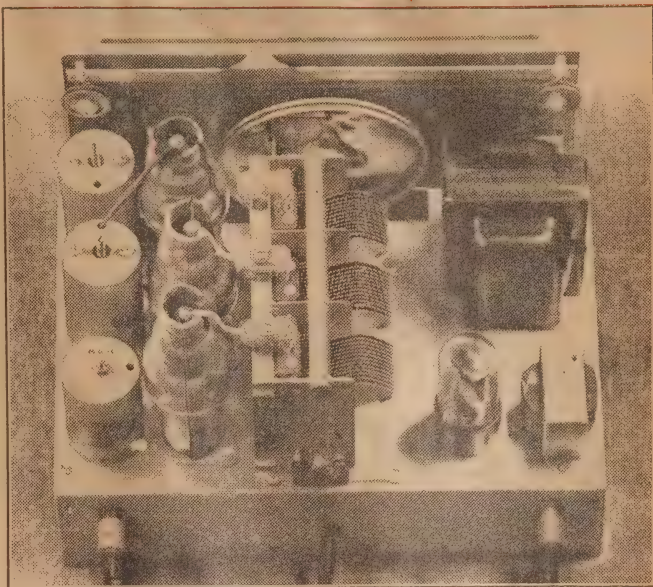
These remarks, of course, apply to almost any tuner.

POWER SUPPLY

In many cases the additional 10 to 20 milliamps load imposed by a tuner may represent the traditional "last straw," in which case, the only resource is to provide the tuner with its own power supply. With this in mind we arranged the chassis originally to provide adequate accommodation and the installation of a power supply is shown.

The simplest course is to purchase one of the new low voltage power transformers especially designed and

REAR VIEW OF THE TUNER

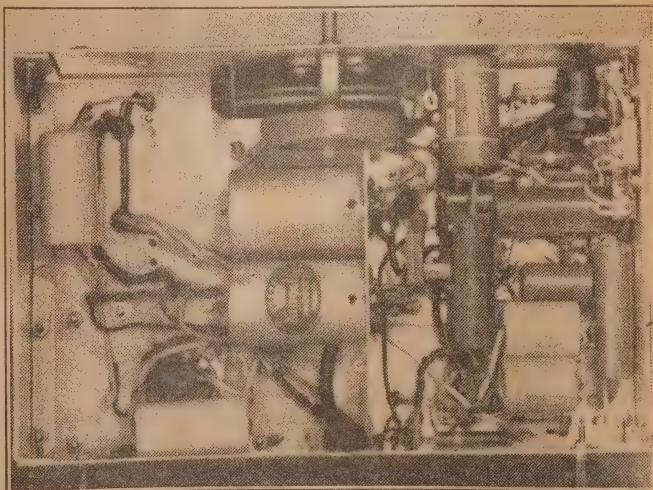


Aerial coil and R.F. amplifier are in the rear left-hand corner, with converter and IFT 1 just in front.

released for our "Minivox" receiver. This has a nominal rating of 150 volts at 30 milliamps and combines very neatly with a 6X5-GT rectifier, small filter choke and a pair of 8 mfd condensers. At a drain of 18 milliamps this combination delivers a filtered high tension voltage of 175, which is ample for the tuner and well below the voltage rating of filter or by-pass condensers.

As we mentioned earlier, the tuner

circuit was originally designed on the assumption of a 250-volt supply, but it will still operate quite efficiently on a voltage considerably below this figure. If you wish to compensate for a reduction in the high tension supply to 175 volts, three minor changes to the circuit will suffice: The 25,000 ohm 2 watt screen resistor can be reduced to 10,000 ohms 1 watt; the 20,000 ohm oscillator anode resistor can be reduced



An underneath view of the chassis. The oscillator coil is near the dial spinner, with the R.F. coil behind it.

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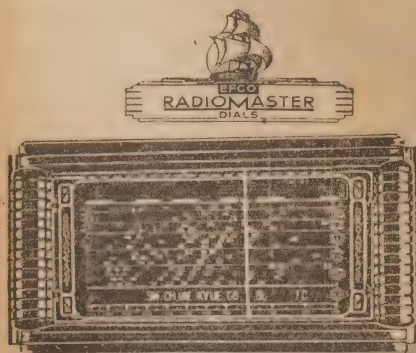
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to 10,000 ohms and the 6G8-G screen supply resistor to 25,000 ohms.

It would, of course, be most unwise to install these lower value resistors and then operate the tuner from more than 200 volts—precisely the reason why we did not specify them in the circuit.

If a higher voltage power transformer is used it would be essential to arrange matters so that no more than 300 volts is applied to the tuner circuits, which requirement may involve the use of high wattage series or bleed resistors. The low voltage transformer is therefore the obvious way of doing the job.

The power supply in exactly the same form could be used with any of the other tuners described recently, superhet or TRF.

CONNECTIONS

There is little else to the story, the method of connection being quite obvious from the circuit. Precautions regarding power supply—should this be derived from the amplifier—have already been outlined in connection with the TRF tuners. Apart from that it is just a matter of connecting the output terminals to the input of the receiver and operating the combination exactly as a normal superhet.

One important point: Never attempt to feed the output of a radio tuner into a preamplifier stage, as for example the input terminals for a microphone or low level pickup. The signal voltage is far in excess of what such a stage can handle and the overload is not relieved by adjusting a volume control later in the circuit. The output from a tuner must be fed through a volume control to the appropriate stage in an amplifier, so that the control could be set for suitable volume without danger of overload occurring.

CIRCUIT ALIGNMENT

The alignment procedure is, of course, exactly the same as for any superhet receiver. We have set it out many times on previous occasions and also have a leaflet on the subject available through our one-shilling query service. However, here it is again very briefly for those who may require it.

First check the adjustment of the dial to see that the pointer overlaps the scale by an equal amount at each end as the condenser is turned from the full-in to full-out position. Then, if you have an oscillator available, connect it to the grid cap of the converter valve and with the receiver gain well advanced and the oscillator output turned low peak the IF transformers for maximum output at 455 kc. If no oscillator is available leave the IF transformer adjustments strictly alone for the time being.

Then tune a signal from a weak station or from the oscillator in the vicinity of 1400 kc and, without reference to the dial calibrations, peak the aerial and RF trimmers for maximum output.

The next step is to tune to a carrier or oscilloc signal at about 600 kc.

(Continued on Page 95)

Now Available the

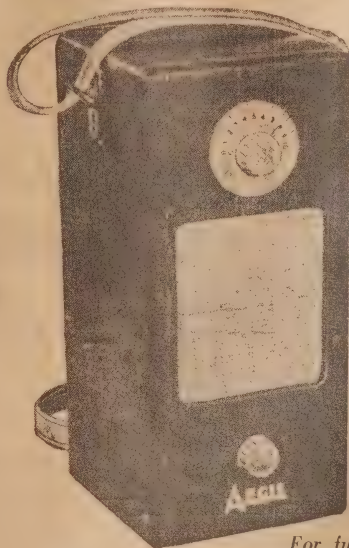
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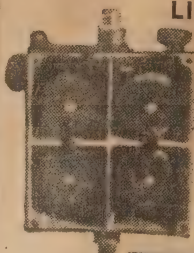
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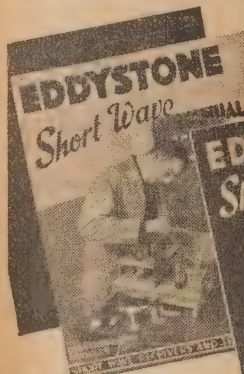
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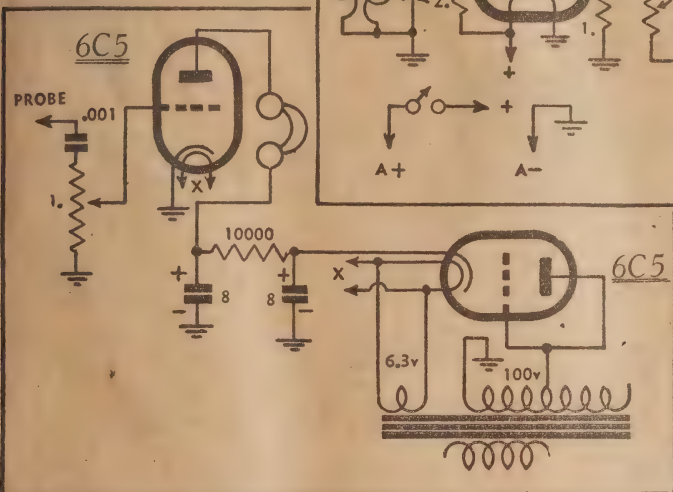
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A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

Half the fun in radio comes from building up gadgets and trying them out. Sometimes they work well, other times not so well, but it's all experience. Here are a few more ideas which Radio & Hobbies passes on to you from other readers. So out with the "junk" box and go to it.



Another signal tracer circuit! All it consists of is a simple triode with earphones in the plate return and a grid circuit which looks like a combination of audio amplifier stage and grid leak detector. Another similar triode acts as a half-wave rectifier, operating from a low voltage transformer and into a simple resistance filter system. There's plenty of scope for odd bits and pieces here. (From B. T. Cooke, 211 Glover-road, Hawera, NZ.)

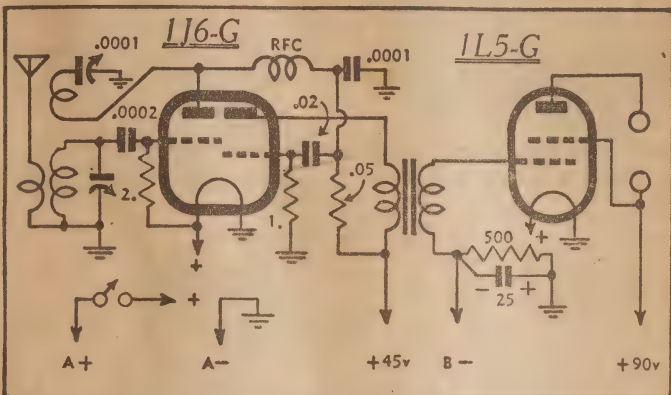
SUNDRY HINTS AND TIPS

IN erecting an outside aerial, it is a common mistake to pass the wire round the egg-shaped insulator, then back around itself for three or four turns before taking it down to the receiver. The sharp bends sooner or later cause the strands to break. The best way to avoid this is to take the wire along the groove, through the hole and back along the groove on the under side. Twist over the horizontal wire, then pass back along the upper groove and down. The wire thus enters the insulator at one end and leaves at the other. In doing so, it prevents twisting of the wire and the half-yard.

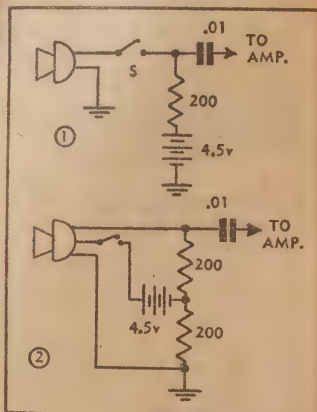
To guard aerial pole against white ants, drill five or six holes

of about 1/4-inch diameter around the circumference of the pole from ground level to about two or three feet. Place in each two or three crystals of bluestone, fill with a strong solution of the same and cork. Refill with the liquid several times. This should also prevent fungus or dry rot. Make sure, by the way, that there is nothing leaning against the pole higher up to provide an alternative path for the ants.

Another handy little point: To start a screw in a difficult spot, pass it through a thin piece of cardboard to hold it in place. When the screw is started, simply tear the cardboard away. (R. Kerr, Longwood, SA.)



The circuit above comes from Mr. H. Hearne, of Victoria Flat, Binda, via Crookwell, NSW. The 1J6-G section of the circuit is basically "Little Jim's Mate," but the addition of an output stage makes it into a loudspeaker set. Mr. Hearne used the PM2A originally, but we changed it to the more readily available 1L5-G. Mr. Hearne says he has received 20 broadcast stations in the daytime, with plenty more at night.



The quality from many carbon microphones worried Mr. B. S. Stevenson of 45 Pittwater-road, Pymble, NSW, until an outside broadcast operator pointed out to him that distortion was often introduced by poor microphone transformers. Cutting out the transformer and increasing the amplifier gain to compensate was found to give much improved results.

Build It Yourself and Save

KIT COMES COMPLETELY ASSEMBLED
Can be wired in 30 minutes



£10/17/6
(Freight Extra)

The Model Kit assembled and ready for wiring, circuit diagram and detailed operating data for the completed instrument.

By self-construction you become fully conversant with the circuit—and you obtain a full working knowledge of the instrument.

Signal FEATURES: Tracer

- * COMPARATIVE INTENSITY OF THE SIGNAL IS READ DIRECTLY ON THE METER—QUALITY OF THE SIGNAL IS HEARD IN THE SPEAKER.
- * SIMPLE TO OPERATE—ONLY ONE CONNECTING CABLE—NO TUNING CONTROLS.
- * HIGHLY SENSITIVE—USES AN IMPROVED VACUUM-TUBE VOLT-METER CIRCUIT.
- * TUBE AND RESISTOR CAPACITY NETWORK ARE BUILT INTO THE DETECTOR PROBE.
- * BUILT-IN HIGH GAIN AMPLIFIER — ALNICO V SPEAKER. COMPLETELY PORTABLE — WEIGHS 8 POUNDS — MEASURES 5½" x 6½" x 9".

1 VALVE KIT (Battery)

Kit includes all parts, phones, valve, batteries, etc.
(Freight extra). **£6/19/6**

2 VALVE KIT (Battery)

Kit includes all parts, valves, cabinet, phones, etc.
(Freight extra). **£8/12/6**

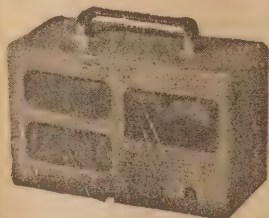
3 VALVE A/C KIT

A midget mains kit. Uses midget parts, 3" Rola etc. Lovely cabinet.
(Freight extra). **£10/12/6**

4 VALVE PERSONAL KIT

Includes all parts, cabinet, 3" Rola, batteries, valves, etc.
(Freight extra). **£12/19/6**

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4-VALVE Midget A/C KIT

A midget 4-valve super-het, uses Hi-Gain valves, 3" Rola, ultra-modern cabinet. Kit comes assembled ready to wire.
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We carry extensive stocks of parts and accessories, all radio valves, test equipment, public address, inter-communications, amateur equipment, hardware, tools, kit-sets, radios, etc.

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NEW WELDED STEEL INSTRUMENT CASES

Grey, crackle finish—ideal for oscillators, signal-tracer, vtm's, etc. 9in. x 6in. x 5½in.
(Freight Extra) .. **22/6**

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Have us quote you for your kit. Whether it's radio, amplifiers or any type of Electronic Equipment. Write us and we will forward quote immediately.

Should you so desire, we will, for a small additional charge, supply you with the kit, custom built, fully wired and tested. Write us and forward details of the kit your require.

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- (2) A 2-valve battery which covers both b/cast and S/W.

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24/- each.

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Single Gang 12/6
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(Post extra)

Headphones, new
2000 ohm 25/-
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Trnsfms.

As per W/wkly.
for 807 P.P. R/
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Brand new 58P1
5" C. R. Tube.
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6v-220-Vib. Packs. Fully filtered, etc., in strong steel case. (Cannot be repeated). Weight packed 25lb. Freight Extra .. **85/-**

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Highly-polished metal probes, with poly tip, takes button type tube. Ideal for vtm's signal-tracers, etc. .. **8/6**

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6AK5	.. 28/-
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TRADE REVIEWS AND RELEASES

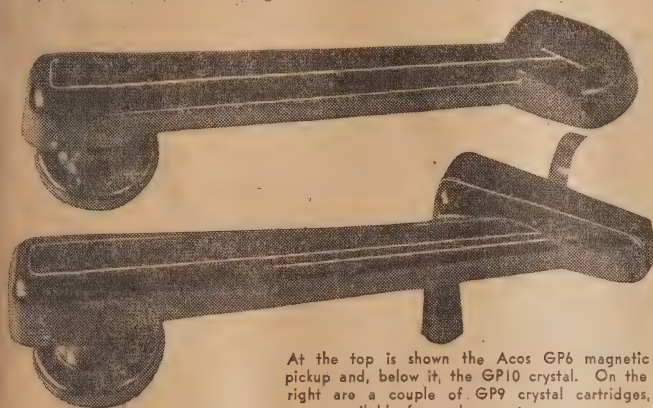
ACOS PICKUPS AND REPLACEMENT UNITS

Manufactured by the well-known Cosmocord Company "Acos" pickups and crystal cartridges are now available on the Australian market. Modern in design and appearance, they retail at very attractive prices.

THE crystal cartridge shown on the right is designated as type GP9. Although manufactured by Cosmocord, it is of a distinctive design and

slackness. Output level is approximately 1.7 volts and normal needle pressure is 35 grammes. Retail price of the GP10 pickup is £2/8/6.

The GP6 magnetic pickup is also available for those who prefer this type of unit. Like the crystal type, it has a moulded bakelite arm and base, with adjustment for the needle pressure. Normally this is set at the



At the top is shown the Acos GP6 magnetic pickup and, below it, the GP10 crystal. On the right are a couple of GP9 crystal cartridges, available for replacement purposes.



factory at two ounces for best average performance.

The GP6 delivers approximately 0.36 volt across the recommended 50,000 ohm load. The response extends from 40 to approximately 5000 c/s, where it falls away rapidly. Retail price is £2/4/1.

Supplies of all these units are available through trade houses. Wholesale inquiries to Amplion (A'asia) Pty. Ltd., 36-40 Parramatta-road, Camperdown, NSW.

features an unbreakable crystal mounting arrangement. The needle chuck floats in rubber and does not transmit vertical shocks to the crystal element. Dropping a pickup will thus chip the record but not damage the cartridge.

Dimensions of the cartridge are similar to other flat cartridges using the "twister" principle so that, in the majority of cases, it forms a direct replacement.

The GP9 cartridge operates normally into a load of 0.5 megohm and delivers an output of 1.7 volts at 1000 c/s under test conditions. The unit has a rising bass response, characteristic of crystal pickups, exhibits good fidelity characteristics and is protected internally against normal humidity effects. Retail price is only £1/2/1.

The cartridge is included in the Acos GP10 crystal pickup, also shown on this page. The arm and base are moulded in bakelite and designed to be as free as possible from resonance effects. A handy finger lift is provided and the whole arm may be tilted back to a vertical position—which it will retain—for ease of needle change.

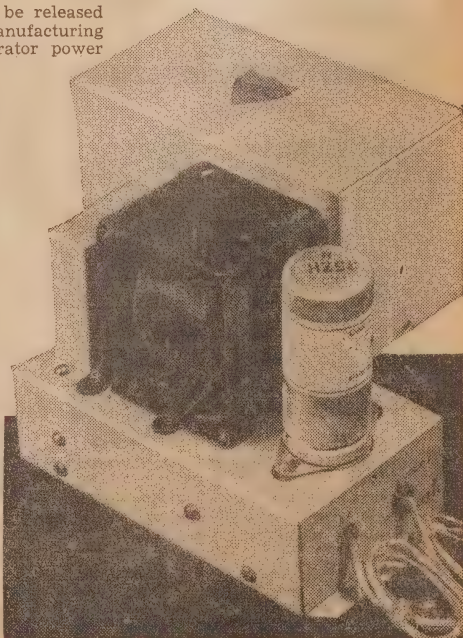
A beryllium copper spring device in the base provides some adjustment for needle pressure, while carefully fitted bearings on the base ensure a freedom of rotation without

AEGIS RELEASE VIBRATOR UNIT

LATEST product to be released by the Aegis Manufacturing Company is this vibrator power supply unit.

Known by the type number, VP1, the unit is available for operation with either a 6-volt or a 12-volt supply, and to deliver either 150 or 250 volts output at 40 milliamps. The circuit includes all the chokes and condensers necessary to give full filtering of the low and high tension output circuits. An oak vibrator is fitted as standard.

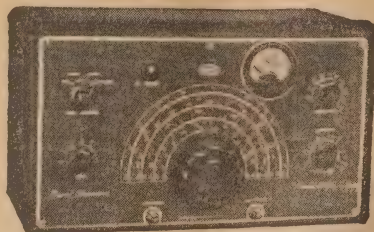
The power supply unit is mounted on a small chassis, which is then housed in a metal cover and base plate. Overall size is approximately 7in. long x 5in. high x 3½in. wide. The manufacturer's address is 208 Little Lonsdale-st., Melbourne, C.I.



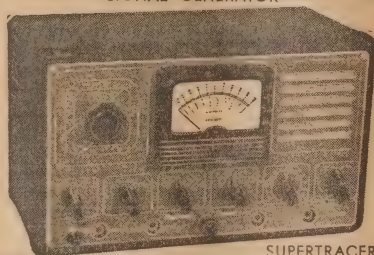
4 NEW TEST INSTRUMENTS



Yes, you can always rely on Electronic Parts Pty. Ltd. for the latest and best in all radio requirements. This month we bring you **FOUR** new test instruments from the famous "University" line.



SIGNAL GENERATOR



SUPERTRACER

NEW OSCILLATORS (Above)

Model XOA (A.C. Operated) or model XOB (internal battery operated) is designed to suit the needs of the average serviceman. Frequency coverage 160 K.C.—32 megacycles in five bands. Unmodulated, modulated or audio output. Fixed modulation 400 cycles at 30% modulation. Calibrated capacity type piston attenuator.

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Ideal for the trained radio service engineer. Frequency coverage 50 K.C.—110 megacycles in seven bands. 400 cycle modulation variable from 0 per cent. to 100 per cent. Calibrated capacity type piston attenuator. Features "Spot Tuning" providing common dial setting for all normal alignment frequencies.

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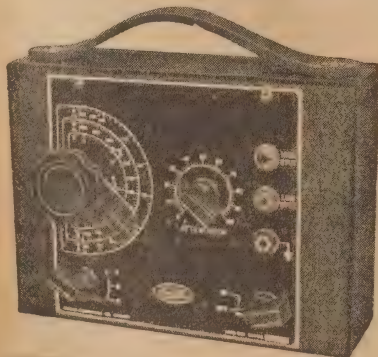
SUPERTRACER

A Comprehensive four band signal tracer covering from 175 K.C. to 15 megacycles. Provision is made for visual and audible signal indications, either separately or together. A multi-range vacuum tube voltmeter is built in and helps to make this instrument a real time saver and profit earner for the radio service technician.

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Send for free descriptive leaflets.

For the Student, Serviceman and Experimenter.



(Right)

The "University" model MK1 AC-DC Multimeter kit you can build yourself. Fitted into the same box as the OK1 oscillator, these instruments make an attractive and efficient pair for the serviceman and experimenter. A most comprehensive multimeter.

PRICE ONLY £8

PLUS SALES TAX

Leaflets fully describing these two kits, and all other "University" Instruments, are available upon request.



MODEL MK1 MULTIMETER

MODEL OK1 OSCILLATOR

Designed to give years of accurate service yet simple to build at home with a few ordinary tools, the new University OK1 oscillator kit covers all fundamental frequencies in the average receiver. Dial is specially pre-calibrated, and every kit is complete with instruction book giving pictures and wiring diagrams.

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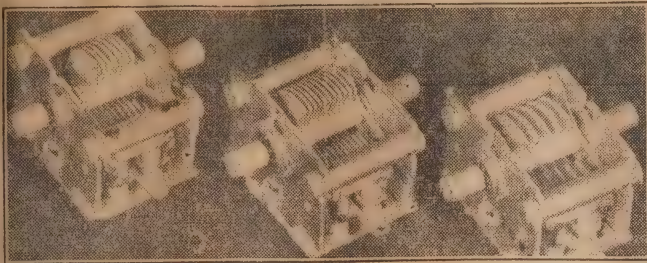
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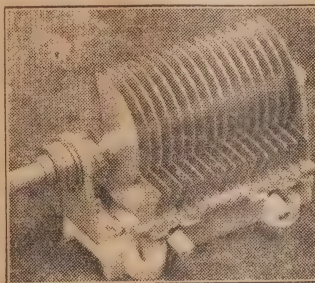
MIDGET TUNING CONDENSERS

BOOK REVIEW COLUMN



UNITED RADIO DISTRIBUTORS, of Phillip-street, Sydney, have good stocks of imported midget condensers suitable for both receivers and transmitters. The three condensers illustrated above are English Pola units, having capacitance figures of 50, 100 and 17.5 pf respectively. The 17.5 pf unit is double spaced. The same condensers are also avail-

able with a 25 and 75 pf rating. All types use ceramic insulation, double ball bearings, wiping contacts and are dull silverplated. Overall size, exclusive of shaft, is 1½ in. x 1½ in. x 1½ in. The double spaced Jackson condenser illustrated below measures approximately 3 in. x 1½ in. and is suitable for use in all medium power transmitters.



RECORD PLAYER FROM RADIO HOUSE

THE record player illustrated below is available from Radio House, 296A Pitt-street, Sydney. As a complete unit it retails for £19/18/-, but the parts can be bought separately, if desired. The amplifier, with

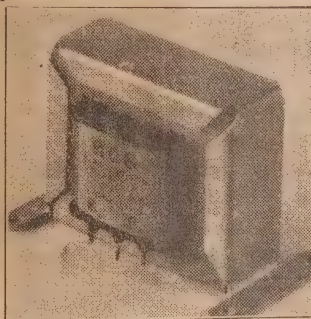


6 in. speaker and valves, sells for £8/17/6. Motor and pickup cost £7/5/-, while the leatherette-covered case costs £2/17/6.

Normal valve complement for the amplifier is 6SJ7 amplifier, 6V6-GT output, and 5Y3-GT rectifier, so that adequate power output is available for home use.

A 6 in. speaker is fitted into the cabinet, but sockets are available for attachment to an external permanent speaker. Either 10 in. or 12 in. discs can be played.

R.C.S. TRANSFORMERS



RCS Radio have redesigned their prewar range of audio transformers and the new types are available, with split windings, on trolitul formers. Types TB42 and TB43 are respectively single-sided and push-pull class A transformers intended primarily for replacement purposes. Ratio is 1.3. Type TB44 is for use in class B amplifiers and has a step down ratio.

THE RADIO AMATEUR HAND-

BOOK, 25th Edition, 1948, published by the ARRL, Australian price 16/9 (approx.), plus postage.

The ARRL Handbook is so well known to most radio enthusiasts that it scarcely needs introduction. Sufficient to say that it represents a compilation of material—theory and practice—which meets the needs of amateur operators the world over. More than that, its pages contain sufficient elementary material to make it a worthwhile investment for the enthusiast who may not have any immediate ideas of taking up amateur radio as a hobby.

Although the book conforms to previous editions in general appearance, it has undergone apparently the most complete revision for many years. In a large measure this has been involved by a change from the text-book styling of the war years to a less academic, more matter-of-fact approach.

New chapters have been added on ultrahigh frequencies, station assembly and the elimination of broadcast listener interference. This material, together with descriptions of new apparatus, accounts for 100 additional pages in this new edition.

Our copy from McGills Agency, 183-5 Elizabeth-street, Melbourne.

"THE Caravan and Touring in Australia" is a new year book released by the monthly magazine, "Motor Manual." The 1948 issue is the first edition, and new editions are planned for each year.

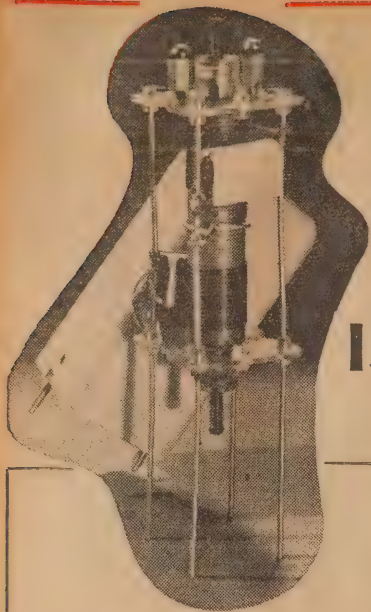
The first section gives essential details of caravans commercially available, with inside and outside photographs. For those who prefer to build their own, there are plans and specifications for four representative types, together with sundry tables and constructional hints.

A third section lists the camping grounds in all States, with a brief note on location.

Final sections in the book deal with towing and road tactics, maintenance problems and the traffic regulations in respective States governing the use of trailer caravans. The book has 80 quarto pages and sells for 3/9. Our copy from McGills Agency, 183-5 Castlereagh-street, Sydney.

"NOTES on the Development of Television," by J. R. Caldwell. (Bulletin No. 22).

This booklet has been produced recently by the Museum of Technology and Applied Science, Harris-street, Sydney. It is available at the Museum for 1/- and relates in particular to the display of television equipment which has been set up as part of a special electronic section. Radio and electrical students should welcome this move by the director, Mr. A. R. Fenfold, F.A.C.I., F.C.S.



There **IS**
Something New in Radio

F.M. (narrow-band) I.F. TRANSFORMERS (By Kingsley of course!)

Kingsley's research engineers have been engaged for some considerable time on the development of intermediate frequency transformers for F.M. operation. They have perfected for use in "narrow band" F.M. systems the new types—KIF 21 and KIF 22—tuned with Kingsley Iron Cores, type 114/8.

The iron powder known as IRN8 used in the manufacture of these cores possesses special H.F. characteristics eminently suitable for operation to 100 megacycles.

KINGSLEY TYPE KIF 21 (illustrated here) is a high frequency Intermediate Frequency Transformer suitable for "narrow band" F.M. systems using ± 15 kilocycles deviation or ANY OTHER APPLICATION WHERE A HIGH FREQUENCY I.F. CHANNEL IS DESIRED.

TYPE KIF 22 is the Discriminator transformer for use in conjunction with KIF 21 in the system as described.

These I.F. Transformers are core-tuned with a "Q" figure of 180 giving a dynamic resistance at 10.7 megacycles, of 36,000 ohms. Dimensions of the can are $3\frac{1}{4}$ inches x $1\frac{1}{2}$ square. Further particulars of these outstanding products and type 114/8 iron dust cores may be obtained on application.

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Nearly 30 different and distinct types are available, including the new miniatures. All Kingsley components are subjected to rigid tests and examination before leaving the factory—your guarantee of high-class performance and reliability.

COILS

Incorporating the Kingsley iron-core technique, the range of "Permacore" and "Permaclad" broadcast, short wave and car radio coils enjoy an unrivalled reputation for efficiency, uniformity of performance and long life. There is a coil to suit your purpose—455 K.C.—175 K.C.—1.9 M.C. for use with "F" or "H" gang condensers.

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If your usual supplier is unable to supply your requirements of Kingsley products—drop us a line mentioning his name and address.

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TURBINE ENGINE IN LANCASTER



THE Armstrong Siddley Mamba airscrew turbine engine made its first appearance, flight recently installed in the nose of a Lancaster. A special compartment was arranged in the aircraft to accommodate two observers. Duplicated engine controls, automatic observers in the form of two standard F.24 cameras and a large number of instruments were also contained within this compartment to enable a detailed study of the engine performance. A De Havilland constant speed fully feathered propeller was used, a separate control for which is not required, the propeller and engine controls being linked to a single pilot's throttle lever. This arrangement has been found to provide very satisfactory handling characteristics in flight which can be judged from the fact that the power can be increased from zero to maximum in two seconds, under baulked landing conditions. The engine can be stopped, feathered and re-started in flight over the full range of airspeed covered by the Lancaster. The neat arrangement of the installation is evident from the photograph. Although the jet pipe slopes down at 20 deg. from the horizontal, the 320 pound thrust from the jet exhaust does not affect the aircraft's trim and directional stability. At present the Mamba is scheduled for the following aircraft: the AWA Apollo four-engined airliner, the Avro Athena and the Boulton Paul Balliol, both single-engined trainers.

The Perfect Employee . . .



THE "AVO" TEST BRIDGE

Illustrated is the A.C. Test Bridge—a portable self-contained 50 cycles measuring bridge giving direct measurement of all sizes of condensers and resistances normally met in radio and electrical engineering . . . the instrument may be used as 0-15 volts vacuum tube voltmeter. Enquire now for details of the full AVO range.

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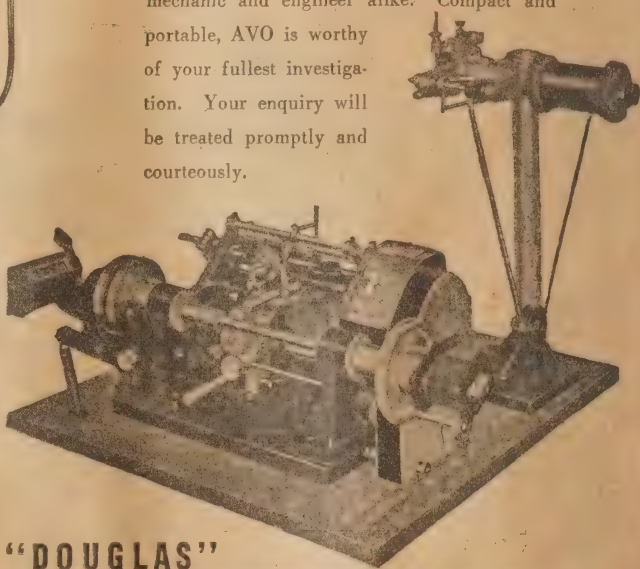
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"DOUGLAS" COIL WINDING MACHINES

Available in 14 models and made by the makers of the famous AVO Test Instruments, Douglas coil-winding machines cover every coil-winding requirement . . . An automatic paper inserter can be fitted on most models and the 5-figure counter can be set to stop the machine at a pre-determined figure. The speed range is 500/6000 r.p.m. There is also a special model -- The Multi-winder -- capable of winding 12 coils at once. Let us quote on your requirements now.

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BRITAIN'S BIG 4-ENGINE BOMBER

Britain's 50-seat Handley-Page "Hastings," developed as a fast military transport, has been seen in Australia recently. Australian Air Force experts have had an opportunity to examine this four-engined machine, which might be well suited to the specialised requirements of servicing Australia's forward bases in time of war.

THE Hastings, which is now in production as the RAF's standard long-range transport, first appeared in 1946. Sketches here (top, and lower left) show two views of the plane in flight.

Power comes from four Bristol Hercules radial engines of 1675 horsepower each, driving four-blade propellers. Cruising speed of the machine has been revealed as 305 miles an hour. Range is 3225 miles.

VARIOUS ROLES

Operational roles of the Hastings include:—

- A freighter capable of carrying 7½ tons of guns or lorries.
- An air ambulance with accommodation for 32 stretchers and 24 sitting cases as well as four attendants, and providing stowage space for a ton of medical supplies.
- A troop transport for 50 fully-equipped soldiers or paratroops.
- A glider tug.
- The plane can carry such diverse and heavy equipment as jeeps, 25-pounder guns and 15cwt. trucks. Jeeps and six-pounder guns can be dropped by parachute from it. A specially large freight door facilitates the loading of such bulky cargo.

The Hastings is of even greater dimensions than Britain's famous wartime heavy bombers. Its wingspan is 113ft. and its length 82ft. 2in. It is a low-wing monoplane, with a single fin and rudder.

A civil version, known as the Hermes, carries 63 passengers.

GLOSTER METEOR

The other plane sketched, the clipped-wing version of the Gloster Meteor, is now in production for the RAF and, while its general performance is about the same as that of earlier models, the clipped wing results in greater manoeuvrability.

The plane, which mounts two Rolls-Royce "Derwent V" turbo-jet engines, has a cruising speed of 350 miles an hour and a top speed of 585 miles an hour.

It is interesting to note the considerable differences in flight characteristics that result from altering the span of the wing. As between different types of aircraft (fighters, bombers, racing craft and so on), the proportion between the wingspan and the chord (wing width) varies greatly.

The chord divided into the span is known as the "aspect ratio." Thus an aspect ratio of six means that the



span is six times as great as the chord. Aspect ratio varies from four for a racing type, five to six for a fighter, and may be as high as 11 in the case of a bomber.

In "Planes Explained," Roger Tennant gives the following reasons for these design features:—

"A wing with wide chord and a short span when flying at a high angle will allow a lot of the air pressure under the wing to escape at the tips, causing a general upset of the air-flow, and reducing the lift, whereas with a wing of every great span and small chord the losses at the tip will be far less.

"Thus a high aspect ratio wing will give the same amount of lift as a low aspect ratio wing at a smaller angle to the air-flow, which means that its resistance is much less.

RACING PLANES

"If an aeroplane is designed to be very lightly loaded in proportion to the horsepower of its engine or to fly very fast, its wing will meet the air at so small an angle that the effect of tip losses referred to will be very slight, so that aspect ratio is unimportant and it will, therefore, be made fairly low as this makes a lighter and more compact wing. Thus racing and fighting

aeroplanes have low aspect ratios.

"Although employing a very short span and wide chord for a fighter it will not noticeably affect its top speed, a high rate of climb is also necessary, and here the wing is meeting the air-flow at a greater angle and the aspect ratio once more becomes important.

"Thus an aircraft built purely as a racer may have an aspect ratio as low as four, but a fighter, which must also be a good climber, is somewhere about six."

Jet Plane Holds Speed Record

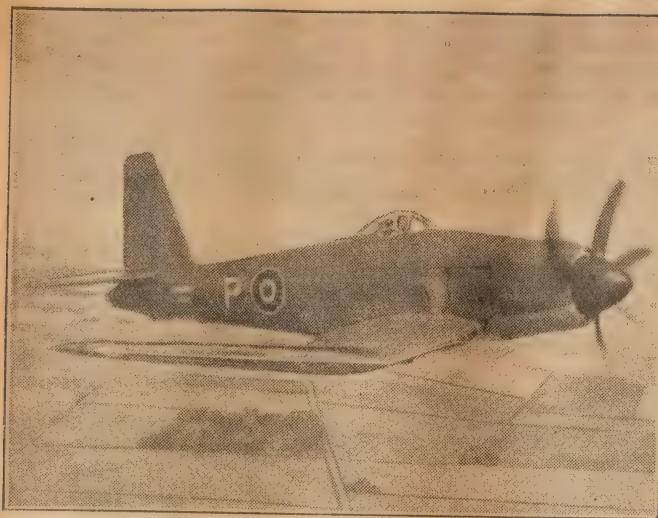
(Continued from Page 19)

pressed by the still fast-moving air entering behind it, which acts like a ram. The air under pressure goes into combustion with the fuel, and the hot gases expand.

This expansion takes place in the nozzle-shaped after-end of the athodyd, which steps up the velocity of the gases, and jets them to the rear. Thus, by pushing the air out faster than it comes in, the athodyd moves forward by reaction.

The athodyd is not self-starting and must be brought up to its critical speed by an auxiliary power plant such as a gas-turbine or by rocket power.

PICTURE NEWS OF THE WORLD'S SKYWAYS



ABOVE.—The most recent addition to the Royal Navy's fighter strength is the Blackburn S.28/43 Firecrest. Designed specially for dive bombing and torpedo operations the S.28/43 carries no guns. Provision was originally made to carry two .50 calibre machine guns in the wings just inboard of the first folding point. If required, two additional guns up to 35 mm cannon could be hung below the wing in place of the two 500 lb. bombs which are specified in addition to the standard Navy torpedo. Tests to date show that the plane has a speed approaching the 400 mph mark.

Dove Contract

A CONTRACT for 50 de Havilland Dove light transports for the use of the Argentine Government has been received by the de Havilland Company.

The order, which follows an earlier one for 20 Doves, includes quantities of spares, and will contribute nearly £2,000,000 to British export revenue.

Some of them will be fitted with special equipment for combatting locust plagues.

Already the subject of praise from numerous countries, including America, the Dove has been further favorably commented on by a writer in India.

Following a flight in an Airways-India Dove, he says: "She must be about the trimmest, snuggest aircraft flying anywhere in the world today . . . really large windows defeat that 'boxed-up' feeling which attacks most new air travellers . . . air-conditioning, excellent upholstery, quietness and stateliness in flight and lack of 'rattle' are reassuring evidence of high quality British workmanship and make the Dove an airliner in miniature.

"It is," he says, "in the high tradition of de Havilland design, performance and efficiency."

Orders totalling more than £6,000,000 have been placed by 22 countries.

Convair Cost

CONSOLIDATED Vultee is withdrawing its price of 360,000 dollars on the Convairliner pending a survey of increased production costs.

The 360,000-dollar price tag was set last September.

Convair definitely plans to continue production of the transport, which is vying with the Martin 2-0-2 as the principal postwar twin-engined airline transport.

AIRFREIGHT totalling 10,960,273 ton miles, flown by American Airlines, in the first 11 months of last year, set a new all-time high for a year by a scheduled air carrier, the air line company announced recently.

Tiny Fighter

FIRST McDonnell XP-85 "parasite" fighter is now undergoing full-scale wind tunnel tests at the National Advisory Committee of Aeronautics' Ames Laboratory at Moffette Field, California.

The tiny fighter was placed aboard a Boeing C-97 Stratocruiser and flown from St. Louis to the laboratory.

The second experimental aeroplane will be flown direct to Muroc Air Base, California, for its first flight drop from a B-29 bomber.

Flying Wing Jet

NORTHROP'S second YB-49 Flying-Wing jet bomber was flown from the factory field near Los Angeles, to Muroc Field Air Base recently.

While the take-off weight of the aeroplane, having a design gross weight exceeding 200,000lb., was not given, the take-off performance was spectacular, even at its probable light loading.

The plane was off the runway at 3000ft., and had gained an altitude of between 500ft. to 600ft. at the 5000ft. terminus of the runway strip.

It is the second of two experimental planes ordered by the US Air Force as jet versions of the XB-35.

Two 'Copters

AT Southampton Airport, Hampshire, two interesting helicopter projects are approaching completion.

One, already announced, is the 24-seat W-11 Air Horse, the world's largest helicopter; the other, now mentioned for the first time, is a light, two-seat helicopter with a selling price well below £2000. Both are products of the Cierva Company.

The two-seater is the W-14 Skeeter. It weighs only 1200lb. with "two up," and has a well-tried British engine.

Cierva officials believe that the simplicity of its design and the ease with which it can be flown will appeal strongly to the private flier, and probably to the flying club member.

The helicopter is largely independent of airfields and question of transport between home and airfields may often be solved by a helicopter.

Several British town-planning authorities are already considering building helicopter parks in anticipation of the helicopter age.

New Records

FLYING an Attacker jet fighter, Vickers-Supermarine's test pilot, Lieut.-Commander Michael Lithgow has twice raised the world's record speed for the 100 kilometre closed circuit.

The final figure which will be submitted for confirmation to the International Aeronautical Federation is 564.881 miles per hour.

This is more than 21 mph better than the speed recently set up by Squadron-Leader Bill Waterton in a Meteor, and 66 mph faster than the official record held by Group-Captain John Cunningham in a Vampire.

Like Bill Waterton, Michael Lithgow faced unfavorable flying conditions on his first attempt; a gusty wind and slight mist provided a stern test for both pilot and aeroplane, and though the record was raised by 17 mph, the pilot was confident that, given better weather, he could cover the circuit in less time.

On the following day, improved conditions, though still far from ideal, enabled him to increase the record to its present figure.

The Attacker's achievement was particularly impressive, because it was carrying full military equipment and was fundamentally the same as the naval version which successfully completed deck-landing trials on HMS Illustrious.

Powered by a Rolls-Royce Nene turbo-jet engine of 5000lb. thrust, the Attacker is armed with four 20 mm cannon.

* * *

BRITISH European Airways will order 20 to 30 Airspeed Ambassadors transports as replacements for the Vickers Viking on its continental routes.

The Ambassadors are expected to go into service in 1951.

BEA turned thumbs down on the Vickers Viscount.

* * *

THE De Havilland Aircraft Company has named its DH-106 jet airliner, now nearing completion, the Comet, after the famous London-Melbourne racer of a decade ago.

* * *

Sail Planes

THE Czechoslovakian sail plane "Krajaneck," flown by Czech ex-RAF pilot Pilot Marmol, created a new endurance record of 25 hours 5 minutes in England recently.

These "Krajanecks" are now being used to a great extent in the seven Czechoslovak gliding centres, which, together with the 306 aero clubs in the country, lost all their equipment during the war.

At first the gliding centres made-do with old German material.

Now the aero clubs are flying mostly Piper Cubs, some 300 of them, bought from the US Army surplus.

* * *

US Navy Neptunes

BOOSTING its production order of Lockheed Neptunes, the US Navy announced a faster and more heavily armed version of its famous patrol bomber.

The new order for 29 P2V-2's increases the US Navy's total order to 150 of the planes, the original of which currently holds the world's distance record with a 11,236-mile non-stop flight from Perth to Columbus, Ohio.

New features of the P2V-2 include: New series of Wright Duplex Cyclone engines increase take-off power by 600 horsepower, giving a faster rate of climb.

New search radar and a variety of tactical radar equipment are housed in the elongated nose.

Six fixed 20mm cannon in the nose fired by the pilot replaced the two .50 calibre flexible machine-guns on the P2V-1.

Two 20mm cannon replace twin .50's in the dorsal turret.

Turret has also been streamlined. Tail armament has been changed to two 20mm cannon.

P2V-2 also carries 16 five-inch rockets, two torpedoes or 12 depth-charges.

Canadian Tests

THE Canadair DC-4M2 has completed all tests required for approval of the plane by the Canadian Department of Transport and has equalled or exceeded its original specifications.

The four-engined (Rolls-Royce Merlin 620 of 1725 horsepower for take-off) transport has demonstrated a top speed of 345 miles per hour at 68,000 pound gross weight and 333 miles per hour at 80,000 pound gross weight.

The 40-passenger transport has a maximum range of 4060 miles at 10,000 feet and range of 2885 miles at 10,000 feet with its maximum payload of 14,758 pounds.

Civil Aeronautic Administration take-off running length is 5000 feet and landing runway length required is 4600 feet.

Rate-of-climb at 80,000 pounds gross weight at sea level is 960 feet per minute and at 20,000 feet is 640 feet per minute.

Service ceiling at 80,000 pounds gross weight is 26,700 feet.

The DC-4M2 is now in quantity production at the Canadair plant near Montreal and five are already in service with Trans-Canadian Air Lines.

* * *

THE Landgraf Helicopter Company reports satisfactory flight tests on its Model H-2 being built for the United States Air Force.

It is a single-seater, twin rotor model weighing 850 pounds, and powered by a Pobjoy radial engine.

Tudor IV Freighter

THE Minister of British Civil Aviation announces that, following a preliminary report from the Air Safety Board, the Tudor IV may be used by BSAA forthwith as a freighter, but not at present for passenger services.

Pending completion of trials of range and fuel consumption, now being made, the Tudor IV will not fly between the Azores and Bermuda.

* * *

Dutch Fireflies

THE Royal Netherlands Navy, obviously satisfied with the Firefly IV fleet reconnaissance general purpose 2-seat fighters they have been operating for nearly two years, are to receive a further substantial number under a contract just placed with the Fairey company by the Dutch Government.

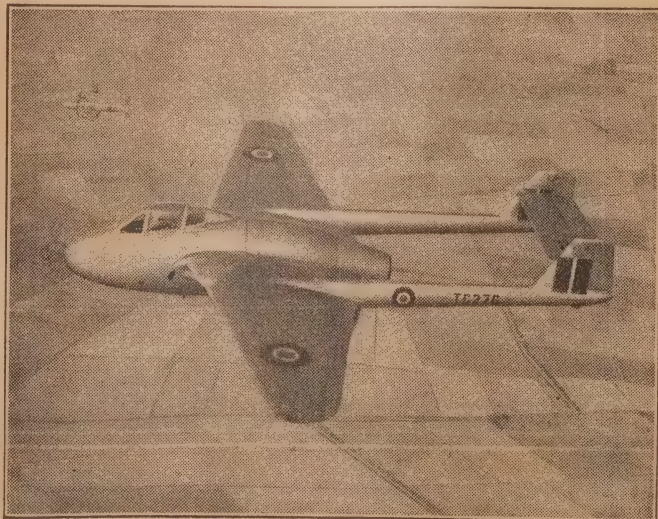
Developed from the Firefly 4, prominent in naval warfare in the closing stages of the war in the North Sea and the Far East, the Mark IV incorporates changes dictated by the knowledge accumulated from combat and flying experience in varying climates and conditions.

It has continued in service with the Royal Navy and has also been adopted by the Royal Canadian Navy.

* * *

AIRFREIGHT totalling 10,960,273 ton miles, flown by American Airlines, in the first 11 months of last year, set a new all-time high for a year by a scheduled air carrier, the air line company announced recently.

Below: This de Havilland Vampire, equipped with a Rolls Royce "Nene" jet engine, is being used to collect test data. Originally fitted with large intakes on top of the cowlings (note the small rectangular panels), these have been removed, all the air being taken in through the new wing root intakes. Australian-built Vampires will be similar.



MAKE YOURSELF A PIN HOLE CAMERA

A pin-hole camera can be very instructive and interesting and, provided that its limitations are realised, quite good photographs can be taken with this simple camera. Of course, one cannot expect the results of a camera costing many pounds—indeed, it would be foolish to do so—but with little practice quite creditable and pleasing results can be obtained.

THE pin-hole camera, is, of course, novel in that it functions without any lens; the image being cast on the sensitised plate surface by a small pin-hole.

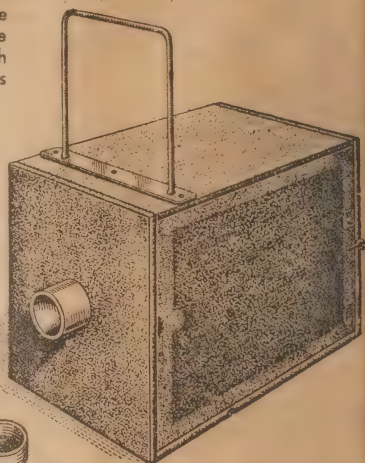
This strange optical feature is often duplicated in Nature by sunlight filtering through the foliage of trees, and projecting a true image of the sun wherever a break in the foliage allows a minute shaft of sunlight to penetrate and strike an object.

The camera that is described in this article can be very easily made from the most elementary materials,

and the clarity of the photographs taken. Unfortunately, in the pin-hole camera one cannot have both. A small aperture is conducive to clear pictorial detail, but if the aperture is too small then the time of exposure is unduly protracted. Therefore, the result must be a compromise, and a normal-sized pin-hole will be found suitable for most purposes.

The bottom portion of the pill-box is now placed on the front of the camera so that the pin-hole in same is exactly central to the hole drilled in the camera front.

With a washer of thick paper interposed between the pill-box and camera front, fasten the pill-box into position with two small screws. Needless to say, it is of the utmost importance to make sure that a light-tight fit is made, and the



The complete camera. Note position of the view-finder.

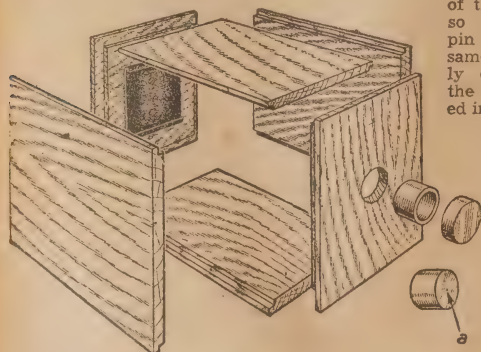


Fig. 1.—An exploded view of the pin-hole camera.

and provides photography in its most simple and inexpensive form.

To construct the camera, two pieces of 9in. by 6in. by $\frac{1}{4}$ in. and two pieces of 9in. by 5 $\frac{1}{2}$ in. by $\frac{1}{4}$ in. smooth wood are required. These are rebated $\frac{1}{4}$ in. along both edges, and joined together with panel pins and glue to form a box 9in. long and 6in. square. The front of the camera is made from a piece of 6in. by 6in. by $\frac{1}{4}$ in. wood rebated to make a close fit into the sides. It will be noticed that all the joins in the camera are rebated. This ensures a practically light-proof form of construction. A hole $\frac{1}{4}$ in. diameter is next drilled through the exact centre of the front, which is then fixed into position with glue and panel pins. (Fig. 1.)

The "lens" of the camera is made from a pill-box or similar article, preferably of the metal variety, complete with lid. A small hole is made in the dead centre of the pill-box with the aid of a normal-sized pin. The size of the hole determines the ultimate speed of the camera,

camera should be held up to the light and thoroughly checked for any light-leakage, not only from the pin-hole assembly, but also from the various joints at the sides and front end of the camera. If any leakage is detected it should be painted with a mixture of glue and lampblack. Sufficient lampblack should be added to make the glue opaque. Slight difficulty may be experienced in rendering the glue and lampblack miscible, due to the oily nature of the latter. If, however, the glue is maintained at a fairly high temperature it will be found that by adding the lampblack in small quantities, and well stirring, the recalcitrant properties of the lampblack will be overcome.

PLATE CARRIER

The back of the camera is made from a piece of 6in. by 6in. by $\frac{1}{4}$ in. wood, rebated for a distance of $\frac{1}{4}$ in. from the edges. A plate carrier is constructed of tin, as illustrated, and is screwed exactly central to the back of the camera. The overall dimensions of the plate carrier are 4 $\frac{1}{2}$ in. by 3 $\frac{1}{2}$ in. The runners are 1-8in. in width, and provide a 1-16 in. clearance to accommodate the plate. (Fig. 2.)

The carrier should allow the plate to slide fairly easily into position, but at the same time the plate must be held securely in place. If the plate is not satisfactorily secured, the runners should be slightly bent inwards to increase the tension on the plate.

A strip of red plush is now glued on to the rebate to ensure a light-

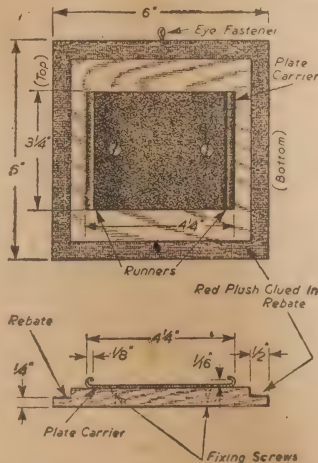


Fig. 2.—Back of camera and detail of plate holder.

tight join when the back is closed. The hinge is made by glueing a piece of American cloth or similar material on to the back and one side of the camera. On the opposite side a hook and eye fastener is fixed. Care should be taken to see that when the back is closed slight tension is imposed on the fastener. This ensures a perfect light seal.

The inside of the camera and the pin-hole assembly must now be painted with a matt black finish. This finish or paint can be obtained at most photographic stores. A glossy paint should not in any circumstances be used, as the reflection from its surface will almost certainly cause "fogging" of the negative upon exposure.

The exterior finish of the camera can be left to the reader's choice. American cloth or leatherette glued into place gives a very pleasing appearance, and, moreover, has the merit of being easily cleaned. Of course, if one decides to cover the camera in one of these materials, the hook and eye fastener must not be fixed until after the camera is covered.

The camera illustrated was covered in leather removed from a very old damaged box camera. Although the job was difficult, the results were very satisfactory.

VIEW FINDER

There, finally, remains the view-finder to make and fix into the correct position. This is made from a piece of fairly heavy gauge wire, 4in. in length by 3½in. in width. This is soldered centrally to a piece of tinplate 6in. long by 1in. wide. The view-finder unit is then secured to the extreme front end of the camera with three small screws, and the camera is then completed.

As before stated, the camera has certain limitations to its use. It is not possible to take instantaneous exposures, which, of course, implies that the subject must be immobile. The time of exposure depends, of course, upon the rapidity of the plate used, and the quality and degree of light at the time of taking. This usually varies between three seconds for brilliant sunshine, and upwards of 20 to 30 seconds for varying conditions.

When taking landscape views, a bright, although not necessarily sunlight, day should be chosen, and should the subject include trees and foliage in the foreground, a calm day is necessary, otherwise the movement of the trees will blur and spoil the photograph.

LOADING

To load the camera, first see that the cap is in position over the pin-hole attachment. The plate required is 4½in. by 3½in., or quarter plate, and it should be fairly rapid. It should be loaded in a dark room by sliding the plate in the carrier with the emulsified surface uppermost. With some plates, notably the Panchromatic type, it is not permissible to load with the aid of a normal darkroom lamp. In this case, the emul-

sion side of the plate can be detected by gently stroking the finger across both surfaces of the plate. The sensitised surface can be found by its matt texture as opposed to the smooth feel of glass.

Before detection by this means, it is advisable to wash the hands, otherwise there is the risk that the natural oils from the skin will be deposited on the sensitised plate surface, and so prevent the full development of those affected parts. When the plate

station was heard quite clearly behind other programmes, although it certainly did not spread unduly when tuned in. A check on operating voltages, valve connections, and alignment revealed nothing amiss, so that the owner was at last obliged to seek assistance—and this is where I actually came into the picture.

Appreciating what had been done, it was not hard to understand the cause of the trouble. It was a simple case of cross-modulation due to the use of an unsuitable R.F. amplifier valve.

What happens is briefly this: In the immediate vicinity of a strong local station, an appreciable signal voltage arrives at the grid of the first valve, even when the set is tuned well away from the frequency of the station. The poorer the tuned circuit or the better the aerial system, the greater will be the unwanted signal voltage.

CROSS MODULATION

In the normal way, it is progressively reduced in strength by subsequent tuned circuits and is not heard in the output of the receiver, except when it is tuned in normally. But the strong signal at the first grid can intermodulate another incoming signal if the grid characteristic of the first valve shows abrupt curvature in the vicinity of the operating point. Chances of cross-modulation increase with high input signals, high A.V.C. bias, and an input stage valve with an abrupt curvature of the grid characteristic.

Cross-modulation was a very common fault years ago when sharp cut-off valves like the 2A4 were used in the R.F. stage. The cure in those days was to reduce the length of aerial to a bare minimum or to install a wave-trap tuned to the frequency of the offending station. Later on, the release of valves like the 35, 58, 6D6, and the more recent 6U7-G just about obviated the difficulty.

I have not had occasion to observe the operation of all the current high-slope pentodes for cross-modulation, but the types most frequently encountered are the 6AC7, EF50, VR65, and VR65A. One could not say that they will inevitably give trouble with cross-modulation, but at least the possibility is there.

The same effect can occur on the short-wave bands, but the chances are more remote, due to the generally lower field strength of short-wave stations.

Another point about using high-slope valves is, of course, that instability may occur if an attempt is made to use the valves under their full gain conditions. Circuit wiring and practice which suffices for valves like the 6U7-G may leave far too much grid-plate coupling for stability when using high-gain tubes. Grid and plate leads must be short and well separated, and in some cases shield-plates are installed across the socket.

THOSE TRIMMERS

Last, but not least, I had a case recently of a man who discovered how a receiver really should be adjusted.

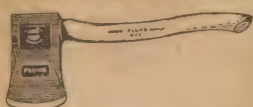
His first complaint was that the receiver sounded harsh before the volume control reached anything like its maximum setting. He reasoned that the volume should go on increasing as the control was advanced until it reached the maximum position.

This is not a new idea by any means, as plenty of people are under the same misapprehension. The volume-control is there purely as an adjustment of listening level. In 99 per cent. of receivers, turning it to the maximum position will cause overload of the output valve—but not before half the neighborhood is aware of the fact that you own a receiver. The accelerator in your car, and the speedometer, cater for far more than the 30 mph speed-limit, but that is no reason why you must readjust the gadgets or alternatively, go careering around the suburbs at 70 mph.

This man, however, was particularly resourceful. He made the startling discovery that fiddling with the little screws here and there made the control operate smoothly from minimum volume to a comfortable maximum over the full range. The only trouble was that a couple of the weaker stations disappeared, together with all the interstate and short-wave signals.

Ah, well! It is a variation on the time-worn theme of the set-owner who begins his repairs by tightening all the loose screws around the top of the chassis. Somebody should tell him that those screws are delicate adjustments to tuned circuits and the whole performance of the receiver depends on their correct setting. But, after all, why should I worry? I'm a radio serviceman.

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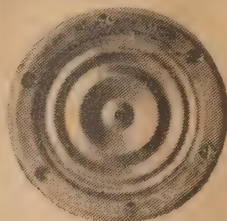
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29/6 ea., F.O.R.

MIDGET SPEAKERS

2in. diam. 1in. deep. Very sensitive floating diaphragm type, these can also be used as microphones. No Batteries NEEDED.



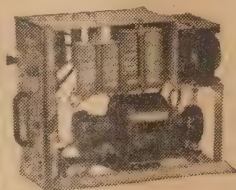
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ROTARY TRANSFORMER

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PRICE

35/-
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Wgt. App. 20lb.

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Approximately 15in. long. 5/6, post 1/-.

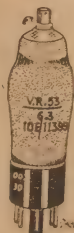
EF 39

NEW VALVES

IN ORIGINAL

CARTONS,

9/6, post 6d.



BOMB PARACHUTES

(Approximately 6ft. in diameter)

Made from Fine Cotton, suitable for handkerchiefs, children's dresses, etc.

PRICE ... 18/6 Ea.

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SORRY, NO C.O.D.'s

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NEW RADIOTRONS

BARGAIN 9/6 ea., post 6d.

VIBRATORS

A.W.A. FS6 Type. 6 Volt Synchronous Octal Base.

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Stirrup PUMPS



American made, with: 15ft. of Hose.

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Size 6ft. x 3ft. with 6ft. drop calico roof and hem. Ideal for both indoor and outdoor use. At the ridiculous price of 14/6, add 1/6 for packing and postage.

HACK-SAWS



Brand new Hack-Saws, with 6 Blades. Priced at 6/11 each, plus 9d postage and packing.

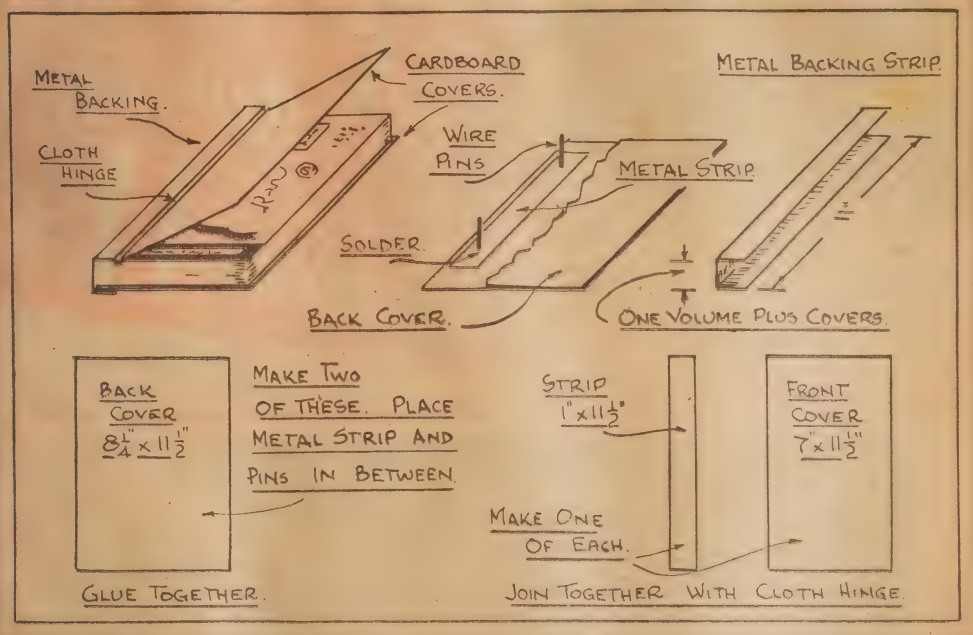
RADIO MART

439 PITT STREET,

SYDNEY, N.S.W.

ML.2351

PROTECT YOUR COPIES OF R. & H.



Readers will be interested in this simple yet effective way of filing their copies of Radio and Hobbies. The volume is held firmly together yet it is a simple matter to remove single copies. Small holes are punched in each copy and these fit over pins in the cover.

TAKE a piece of sheet metal strip—about 7 in. x 1/2 in. is a useful size—round the corners and smooth off the rough edges. Make two pins from nails or stout wire 1 1/2 in. long. Drive these through the tin, keeping them about 5 in. apart. Rivet over the point which has passed through the tin and solder both the pins in place.

The covers are made of heavy cardboard. Four pieces are needed, two 8 1/4 in. x 11 1/2 in. for the back cover, one 1 in. x 11 1/2 in. for the strip, and one 7 in. x 11 1/2 in. for the front cover. In one back cover piece and 1/2 in. from the edge, punch two 1-8 in. long 5 in. apart. Pass the two binding pins with the tin strip soldered to them through these two holes and push the tin up hard against the cardboard.

Now glue the two back covers together with the tin strip in between them. Use plenty of glue and heavy pressure when drying. Join the cardboard strip to the front cover with a cloth hinge, leaving a gap of 1/2 in. between the two pieces of cardboard. Then, if you have some fancy paper, paste it on both covers.

Take a complete volume of Radio and Hobbies and punch holes 5 in. apart along the back edge. Each one

will then fit over the pins in the back cover. Place 12 copies in position, and after punching holes in the cardboard strip, place it on top. Now

carefully measure the thickness of the volume plus the two covers and bend the metal backing strip as shown. It is important that the dimensions here be followed accurately. Make sure all of the sharp edges are smoothed off. This is then slid on to the covers, as shown in the first sketch, and binds the whole firmly together. Paint the metal backing strip a color to match your cover paper.

VALE—GOODBYE TO THE SPITFIRE

(Continued from Page 17)

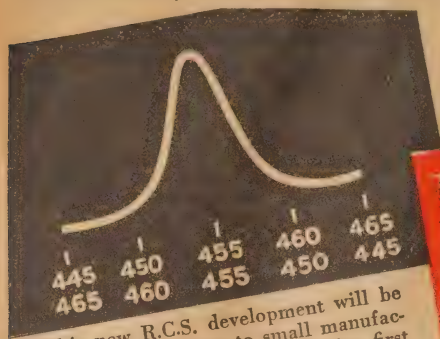
Battle of Britain was mainly a "Hurricane" battle—it was the presence of relatively few but significantly all-conquering "Spitfires" which did much to turn the tide. The German cry of "Achtung—Schpitfeur," first heard over the Forth Bridge in October, 1939, was echoed in real terror throughout 1940. It was still being echoed in 1945!

During its six operational years, the Spit graduated from being a general purpose fighter, into an unarmed long-range photographic reconnaissance aircraft, depending on sheer speed for its escape. On most fronts it later became a deadly fighter-bomber and it finished up by filling, at one time, at least ten different roles for the RAF alone. There were, as example, special high-altitude versions, and there were low-

level ones. Eventually and inevitably there was a deck-landing Spitfire (the Seafire, the Navy called it), which was later re-designed by Smith as the Seafang, though it is still recognisably of Spitfire origin. The original wooden two-bladed airscrew has been three-bladed, four-bladed, and then five-bladed, and has finished as a contra-rotating prop on the Seafang Mark 32.

But in Britain, No. 21,767 is being finished at the Vickers Supermarine factory. Soon only the Auxiliary Air Force of the Home based Fighter Command will be Spitfire equipped—and, overseas, the Spits will be gradually recalled from BAFO, the Middle East, and the Far East (where they are still front-line fighters)—until only trainers and communications hacks remain to wear the service roundels.

NOW YOU CHOOSE THE I.F. TO GIVE THE PERFORMANCE YOU WANT



This new R.C.S. development will be of major assistance to small manufacturers and amateurs. For the first time, you can tell at a glance the relationships of gain or sensitivity, selectivity and tone quality that you can expect from each of the six sensational new R.C.S. I.F.'s.

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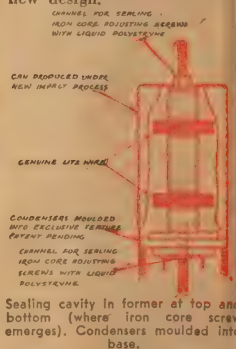
Revolutionary "new" Performance Chart tells you I.F. performance at a glance!

R.C.S. I.F. SELECTION CHART					
TYPE No.			GAIN	SELECTIVITY	QUALITY
1st	2nd	3rd			
IF170	IF171		Standard	Standard	Good
IF172	IF171		Good	Average	Good
IF172	IF173		Good	Sharp	Average
IF170	IF173		Standard	Very Sharp	Fair
IF174	IF174	IF171	High	Sharp	Good
IF168	IF169		High	Good	Fair
(Portable)					
IF169	IF168		Standard	Fair	Good
(A/C Mantle)					

Patents Pending on DESIGN ADVANCEMENT

The new R.C.S. I.F.'s have the amazing new R.C.S. development (over which patents are pending) . . . condensers moulded into the polystyrene base. To enable them to remain constant under all conditions, the condensers are first dried out under infra-red rays, thereby expelling moisture and raising their Q. They are then moulded into the polystyrene former base, an exclusive R.C.S. patented feature, where they are beyond the reach of climatic variations. The aluminium cans, too, are now pressed out under a new "impact" process.

You now choose your I.F. to fulfil the performance you require. If you live in an area in which reception is rendered difficult you will probably require Type 172 or 173 where tonal quality suffers to maintain gain and selectivity at their peak. This sensational R.C.S. guarantee you the performance you specify. Order R.C.S. I.F.'s and other components in your new design.



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Compact
in size,
measures
1 3/4" square
x 2 1/2" high.

MAGNASONIC
MIDGET I.F.
1" DIAMETER

Obtainable from your local Radio Retailer

(Continued from Page 15)

joined division of a single egg early in life. These twins have the same genes and chromosomes and develop all the characteristics identical with each other at exactly the same time and in the same way. This will take place even with twins, triplets, quads, and so on.

It is believed by scientists that every gene in the body has an influence on every other gene. To put this more clearly it can be said that here are hair genes in your finger, and finger genes in your hair. Certain groups of genes are inherited as a group and often these genes seem to have no relation to one another whatsoever. But the effect of the existence of such groups produces what seems at first an absurd situation.

For instance, in some families a given color of hair is bound up in some way with the lack of one or more of certain teeth. Thus it is possible to study certain families and forecast that a child of certain parents, if it has a given color of hair, will possess only seven incisor teeth instead of eight.

But this knowledge may not be so useless after all, for it may be of great value in our fight against inherited diseases.

HEREDITY

Certain diseases are hereditary, and in the case of others it is possible to inherit a predisposition to them. Some of these diseases do not become apparent until middle life, long after the victim has married and passed in the complaint to the offspring.

Many of these diseases are terrible, and medical science knows no way to cure them. If, however, certain linked genes or groups of genes could be found which are not only inherited together but transmitted with the disease, the disease, at first dormant, could be detected in advance because of other characteristics which at first seem unrelated and harmless.

It should not be long before scientists can, by the study of family histories, give warnings in advance of what certain members of the family can expect.

An interesting fact which should be of value to musical parents is that of the characteristics controlled by an individual possessing one gene of a certain type or two of them.

There are two particular genes which cause a man to be a basso and a woman to sing soprano when these genes occur in pairs. Tenors and altos are produced by another kind of gene occurring in pairs. Take one gene from each pair and put them together and you get either a baritone or a mezzo-soprano. The children of a basso and a soprano will be only bassos or sopranos. Those of a tenor and an alto will be tenors and altos, but a baritone and a mezzo-soprano may produce anything up to a full choir.

In the study of genetics scientists have uncovered and "debunked" many popular fallacies. They have proved that heredity and environment have tremendous significance.

(Continued from Page 43)

lator. The crystal, which incidentally was obtained from disposals for 5/-, has a resonant frequency of just over 8 Mc/s, so that the intervening transformer between V2 and V4 must be resonated at just over 7.5 Mc/s.

Unfortunately, suitable high frequency I.F. transformers are not readily available on the market and we had to make up one of our own by dismantling a low frequency unit. Primary and secondary consists of 18 turns of 24 gauge wire, close wound around the 5-8in. former, the dimensions and connections being as illustrated elsewhere. Each winding is resonated with a 50 pf. mica condenser and tuned to resonance by the variable iron slug. You will find that the iron provides only a limited range of adjustment so that it may be necessary to add or remove a turn from either winding to obtain a definite peak. The adjustment will of course be effected also by valve and circuit capacitances.

40 PF CONDENSER

Before leaving the 6J8-G converter it may be as well to mention the 40 pf. condenser between the oscillator grid and earth. This condenser is not essential to the operation of the Pierce circuit with a 6J8-G, but its inclusion will generally improve the conversion gain of the tube. It is worth experimenting with the size of condenser to give best results; too large a value will put the valve out of oscillation.

The low frequency I.F. amplifier, V3, is perfectly conventional, being provided with a gain control in the cathode circuit and a plate current meter to indicate signal strength. A.V.C. is also applied to the grid, being the only-controlled stage in the receiver.

The degree of control is adequate for the 50 Mc band, both in regard to the A.V.C. action and of the oper-

ation of a manual gain potentiometer. For general use on the lower frequency bands, some additional control may be necessary in the early stages, either the R.F. amplifier or both.

The 6H6 serves as diode detector, A.V.C. generator and series noise limiter. This circuit has been mentioned recently in Radio and Hobbies and no further comment is necessary, apart from saying that it is very effective on auto ignition noise and similar interference.

The output from the detector feeds into a conventional audio system with an equally conventional power supply. The only point of comment here, as already mentioned, is the connection of .002 mica condensers across each section of the secondary as a precaution against modulation hum. Although these were desirable in the original set, it is not suggested that they must always be included in a double change receiver.

B.F.O. STAGE

The B.F.O. stage will be necessary for C.W. signals, but can utilise a wide variety of valve types and circuit arrangements. In this receiver we resonated to 455 kc and installed a plate voltage control in place of the B.F.O. "off-on" switch. The potentiometer serves the same purpose but also gives a continuous control over the amplitude of injection voltage.

The accompanying photographs give some idea of the layout adopted in our experimental receiver, but it is not suggested for one moment as the only possible layout, or even the best one. Hence the use of a rather odd collection of valves and components. The receiver is nevertheless technically interesting and will take its place as a pilot model for future receivers of the same general design.

The individual inherits characteristics which will be produced provided the environment is favorable. When the hereditary influences are strong environmental influences are weak, and vice versa. Environment can change a person, but only because of the hereditary characteristics which he possesses or lacks.

Nothing is handed on from generation to generation unless by means of the genes. Thus it is impossible for a child to be marked in some way because the mother had a fright before the birth of the child. One might just as well say that a child will turn out to be a burglar because the mother found one under the bed.

Alcoholism is more of an environmental disease than an hereditary one. If a drunkard's son becomes a drunkard it is possible that his genes may be the trouble, but only because of some instability resulting from some predisposition. But it is more probable that the trouble is through

bad environment in which the father's example played a great part. The same can be said of gambling and other "sins."

Scientists who have made a close study of genetics tell us that by improving our environment and our heredity at the same time we could abolish nearly all human troubles and afflictions in a few generations, and in truth it is within our power to have a race of supermen and women living in peace and harmony.

The sooner we start the better, but it will require a lot of interference with what has now become recognised as "our way of life," and as nobody these days seems to want to be interfered with in any way whatsoever, even for their own good, it seems that the dream of the scientists will not be realised until they alone inhabit the earth after other scientists have provided the means of wiping the rest of humanity off it. Life is indeed a paradox.

International Interference Spoils Voice of America Programmes

During the war we were accustomed to one country jamming the broadcasts of another, usually with a view to preventing their own nationals from hearing information from enemy stations. In these days of so-called peace it is therefore rather alarming to find that such methods are again in use and apparently for the same reason as they were in wartime.

LISTENERS will remember that within the past month or so, the USA have inaugurated programmes in Russian over their Voice of the United States of America stations. These programmes come on the air at 9 nightly and we have noticed that, immediately these programmes commence, a pulsating whistle or "chopper" noise opens up right on the same frequency. This interference is evident on all outlets, including Manila, and varies somewhat on different stations, but usually sufficiently intense to make the programme unintelligible except with very careful listening.

We can only surmise in what country this jamming originates and we only hope that the USA will not be tempted to retaliate. The practice may then become sufficiently widespread to turn the short-wave bands into bedlam.

ELUSIVE STATIONS.—From time to time there are certain short-wave stations which, for some reason or another, are inaudible in some locations. We have had many letters advising us that, although in some cases stations from the same country are easily logged, a particular one defies all attempts to tune it in. The writer has had some interesting examples of this condition, but has never been able to understand why it should be so. It is all the more surprising, and annoying, too, to find that you are unable to hear a station which happens to be one of your pet group.

As readers will remember, the writer has had some success with the South Americans but there is at least one that has never once been heard. ZFY on 6.0 mc located in Georgetown, British Guiana. We know of at least two listeners who have heard and verified this one, but we cannot raise even a whistle from it. Another station we have never been able to log is FO8AA on 6.98 mc, Papeete, Tahiti, despite the fact it is often heard in the USA and other places. We have not heard of any Australian who has received a verification from this one, so the circumstances are a little

SHORT Wave Notes for the June issue are due on May 8. For the July issue they are due on June 4. Please send them direct to Mr. Ray Simpson, 80 Wilga-street, Concord West, N.S.W.

different. Only one listener has reported to us that he has heard FO8AA and that was before the war. Over ten years of trying has never brought success, but some day it may break through.

Nearly every listener has one station or another that perpetually eludes him but, after all, this adds all the more interest in trying for it.

SUMMARY OF LATIN-AMERICANS

At this time of the year the Latin-American stations are audible in most parts of Australia at quite good strength and provide an interesting change from the Europeans. Very few of them use English in their announcements, but, after a time, one can understand sufficient Spanish to identify the station one is listening to. Those listed in the following summary have all been heard at the writer's location during the past few weeks.

ARGENTINA.—The best from this country is undoubtedly LRM in Mendoza on 6.18 mc, which is heard at surprisingly good strength nightly from 8 o'clock. Their slogan is "Radio Aconcagua," which is given on opening, together with their call letters and location. The only other Argentina station heard at reasonable strength is LRY on 9.545 mc, mentioned in our new station list. One other is LRS on 9.32 mc, which can sometimes be heard on Sunday afternoons.

BRAZIL.—So far the Brazilians have not been heard too well, but on a favorable morning ZYB8 on 11.765 mc, located in Sao Paulo, can be logged at fair strength. One other was PRL8 on 11.72 mc, opening at 8 pm.

CHILE.—This is one of the best-heard South American countries and we think pride of place can be given to CE622 in Santiago, which opens with a very fine signal at 9.30 pm and is easily identified

by their slogan of "Radio Sociedad de Agricultura."

On the same band we also have CE604 on 6.04 mc, which opens at 9.45 pm, but with a weak signal and badly interfered with by nearby stations. In locations where VL2R is not too powerful, listen for CE615 on 6.155 mc, as they can sometimes be followed quite well. The best of the other Chile stations are in the 25-metre band where we have CE140 on 11.74 mc, CE1190 on 11.9 mc, and CE1180 on 11.997 mc, all audible around 10 pm, with CE1180 the best at our location.

COLOMBIA.—We rather thought that there would have been quite a number of Colombian stations audible here from April 1 onwards, due to the Conference being held in Bogota. However, at time of writing, we have only heard HJCX on 6.018 mc and ELFA on 6.054 mc, both 10 pm.

COSTA RICA.—The only representative of this Central American country is TIPG on 9.62 mc, located in the capital, San Jose. On some nights it reaches very good strength around 10 o'clock, but now that KZFM is also using this channel, there is quite a bit of interference.

CUBA.—The most reliable of the Cubans is COCX on 9.27 mc, heard every night around 10 o'clock, but it is closely followed by COKG on 8.955 mc. This last one is located at Santiago de Cuba, while the first is, of course, in Havana. Others heard on some nights are COCQ on 9.85 mc, COCO on 8.7 mc, and COCM on 9.83 mc. We nearly forgot COHI on 6.465 mc, which is always quite loud, though troubled by Morse on most nights.

FLASHES FROM EVERYWHERE

JAPAN.—We are indebted to Art Cushman for sending us details regarding some of the Japanese stations. Verifications are now being issued by the Broadcasting Corporation of Japan, by Mr. R. H. Niino, Vice-Chief of Liaison, Broadcasting Corporation of Japan, Tokio. In addition to verification letter, a copy of the report submitted and that which the station actually broadcast is forwarded. Two of the loudest Japanese we are hearing at our location are JVV2 on 9.505 mc and JVV4 on 9.56 mc, which are very loud from the time they come on, the air at 5.55 pm till closing at midnight. Programmes are in Japanese and are far from interesting to listeners in this country.

GUATEMALA.—This country has been in the news quite a lot of late and it is very interesting to note that there are one or two new stations now on the air from that location. Radio Libre on 6.325 mc is heard in New Zealand giving Costa Rican war news till 4 pm on a Sunday. This station is in the capital, Guatemala City, as also is another station, Radio Marimba on 6.22 mc, which comes in on a Sunday with a news session from 4 pm to 4.15 pm, and then signs off with a marimba band selection. One of their stations, TGRA, "La Vox de Guard Civil" on 6.255 mc is heard on Sunday afternoons in NZ, but we have had no report of it from Australian listeners. The only ones we hear ourselves are TGWA on 9.760 mc, and TGWA 15.17 mc.

ITALY.—By a recent mail we received a rather elaborate programme schedule from the Italian Broadcasting authorities which takes the form of a double folded card with a map of Italy on the front and a view of the Coliseum, Rome, on the back. Their schedule appears to be from 1.45 am to 6.45 am on 6.085 mc and 9.63 mc, with news in English at 5.50 am. They have another programme directed at Latin America from 8.30 am to 9.50 am, and a session for North America from 9.55 am to 11.10 am. Both the Latin American and North American programmes are carried over 9.63 mc and 15.12 mc. For those who can read Morse, listen for Roma on 3 am, and on 5.622 mc and 6.65 mc at 10 pm.

CHINA.—Mr. George Major, of Western Australia, has kindly sent us details concerning XMPA Nanking, and XGAF of the same city. The first station, XMPA, operates on 12.2 mc with a power of 1 kw and also has a medium wave outlet on 720 kc. There is a daily 10-minute news service in English at 8.40 pm. Station is operated by the Information and Civil Affairs Department, Ministry of National Defence and the address is 10 Snake Mountain, Nanking.

The second station, XGAF, operates on both 7.1 mc and 11.68 mc with a power of 2.5 kw. A news service in English is given daily at 11 pm. The station slogan is "The Voice of the Chinese Air Force" and the officer in charge at the station is Major C. Y. Chen.

MISSIONARY STATIONS.—One of our original reporters, Mr. R. K. Clack has kindly sent us some interesting information concerning stations in Ecuador and Guatemala. The first is HCJB, the well-known Quito station which has received a 25-year renewal of their licence from the Government. This will probably encourage the station in their long-range expansion programme which includes an increase in power of the 12.455 mc channel to 50 kw.

The Central American Mission has obtained permission from the Guatemalan Government to establish a missionary radio station on both BC and SW bands. The shortwave transmitter is to have a power of from 5 to 10 kw.

SOME RECENT VERIFICATIONS

HJAP, COLOMBIA.—One of the most attractive verification cards we have ever received was one which has just come by air mail from HJAP, Cartagena, Colombia, verifying our recent report on their 9.905 mc transmission. The card was a highly finished photograph of the Costa Rican baseball team taking the field at Cartagena. It was all the more interesting as it was the broadcast we reported on. The leader of the team carries a banner stating that it is the Costa Rican team in the 9th World Series Amateur Baseball. The station slogan is "Radio Colonial" and their verification was received just nine weeks after mailing our report, which certainly is good time these days.

HLKA, KOREA.—A very interesting verification was recently received by Mr. Max Krumbek from the Korean station HLKA. This verification took the form of a letter signed by Mr. Howard S. Peeples, Advisor of the Korean Broadcasting System. The station advises that they use a 5 kw transmitter manufactured by the Japanese Electric, and the antenna is a two-half wave doublet with a frequency of 7.935 mc. Station HLKA and its ten affiliated stations are operated by Koreans under the supervision of the US Armed Forces personnel. Times on the air are noon to 3 pm, 3.30 pm to 1.30 pm, and 7.10 am to 1.30 am. When first heard, we mistook the call letters of this station for XLKA, but HLKA is definitely the correct call.

NEW USA STATION

USA.—There seems no end to the number of outlets from the USA, and, as we write these notes, we have seven new ones to report. As we have mentioned before, some of these channels may have been used during the war years, but we have no personal record of them. The first is one of the World Wide Broadcasting Foundation stations, WRUA, which has been logged on three new channels, 15.2 mc, 15.22 mc, and 15.29 mc, the first two around 8.30 am and the last at 12.30 pm. Another new morning station is WNRA on 11.77 mc, heard around 8 am. KCBR on 15.13 mc can be logged at 11.30 am. The station on the same frequency comes in at 5.30 pm. Lastly we have KQBV on 31.9 mc, a Police Radio in Los Angeles which can often be heard around noon.

CELEBES & INDIA.—Most listeners have become quite used to hearing the Macassar station, which has been using 2.65 mc for some time now. They have now changed frequency to 9.55 mc, a channel which was formerly occupied by YDD3 in Batavia. This new outlet is heard very well nightly from 7 o'clock. Listeners may have noticed that there is a station right underneath KGEI on 9.35 mc. Owing to the strength of this latter station we very hard to identify the other one, but we can now state with certainty that it is an Indian, as the news in English similar to that on 7.29 mc can be heard at 10.30 pm. The only Indian we know of on this channel is VUC2 Calcutta.

FRENCH INDO-CHINA.—Since late last year we have been hearing station on 6.09 mc playing Western type recordings from 9.30 pm till closing at 10 pm with the playing of "In The Mood." Beyond the fact that the only announcement at 9.30 pm comes in French, we can never make anything of it. Quite recently they changed frequency to 6.035 mc, and at last we have heard a clear announcement which shows the station to be "Radio Cambodia" located in Phnom Penh, French Indo-China. They are hemmed in between Kuala Lumpur and Rangoon, which makes it rather difficult to hear them clearly but, by careful tuning, you can separate them and check their identity when they close with "In The Mood," which is well known to everyone.

HAITI.—Stations are few and far between where this country is concerned

NEW STATION LOGGINGS

Call	Kc.	Metres	Location	Time Heard
HH2S	5948	50.44	Port-au-Prince, Haiti.	9.30 pm
HCBJ	5960	50.34	Quito, Ecuador.	9.30 pm
Cambodia	6035	49.71	Phnom-penh, Fr. Indo China.	9.30 pm
JCKW	6075	49.38	Southern Palestine.	6.30 am
KZFM	6170	48.62	Manila, Philippine Is.	8.00 pm
Polskie.	9530	31.48	Warsaw, Poland.	4.00 pm
VUC2	9530	31.48	Calcutta, India.	10.30 pm
LRY	9545	31.43	Buenos Aires, Argentina.	8.00 pm
YFA4	9550	31.41	Macassar, Celebes.	8.00 pm
KZFM	9575	31.33	Manila, Philippine Is.	8.00 pm
KZFM	9620	31.19	Manila, Philippine Is.	8.00 pm
WNRA	11770	25.49	New York, N.Y., U.S.A.	7.30 am
KCBR	15130	19.83	Delano, Cal. U.S.A.	11.00 am
KNBI	15130	19.83	Dixon Cal. U.S.A.	5.30 pm
WRUA	15200	19.74	Boston, Mass., U.S.A.	8.30 am
WRUA	15220	19.71	Boston, Mass., U.S.A.	8.30 am
WRUA	15290	19.62	Boston, Mass., U.S.A.	1.00 pm
KQBV	31900	9.40	Los Angeles, Cal., U.S.A.	11.00 am

ARGENTINA.—For some time now we have been hearing the well-known Buenos Aires station, "Radio Belgrano," operating on a new frequency of 9.545 mc. The station comes in at quite good strength from opening at 7.58 pm with a march, followed by the announcement in Spanish, "Buenos dias, estaciones LR3, LRY, and LRI 'Radio Belgrano,' Buenos Aires." From that time onward they give news items in Spanish which have mostly been on the Pan-American Conference being held in Bogota, Colombia. About every ten minutes they give call as "LR3, Buenos Aires. The call, LR3, is the broadcast band call, while LRY is the shortwave call. Evidently LRI, another broadcast band station, is also in relay. The Russian blot this new station out at about 8.50 pm.

RADIO POLSKIE, POLAND.—This new station was first brought to our notice by Graham Hutchins, of Melbourne, who had been hearing it for some time previously. It comes on the air every afternoon around 4 pm on a frequency of 9.53 mc, and is at excellent strength with its musical numbers and also with its news. Positive identification of its location has not been made but it is thought to be Warsaw. It uses the same interval signal as Warsaw on 6.215 mc, so we think it will be the same. Quite likely this is the old prewar Polish station, SP31, which used to be on 9.525 mc, though we think it will be a different station as it seems to be very much louder than what we remember of SP31.

PALESTINE.—The well-known Forces Broadcasting Station in Jerusalem, which was formerly heard on 7.22 mc, has now turned up on 6.075 mc, where it can be heard at fair strength until closing at 7 am. According to advice from Mr.

and we were therefore very interested to hear that Mr. Moore, of Brisbane, had managed to log HH2S on 5.948 mc. This station is located in the capital, Port-au-Prince and its slogan is "Société d'Enseignement Radiodiffusion." All announcements from this one are in French, and from around 9.30 pm they have musical numbers interspersed with announcements and then at about 9.45 pm they give a new service also in French. Morse interference is very severe around this frequency and as the power used by HH2S is only 300 watts, careful tuning will be necessary in order to tune in this rather elusive station.

RUMANIA.—For the past week or so we have been hearing the Rumanian station operating on 9.25 mc from as early as 5.30 am. They have evidently been carrying out test programmes, as on the hour and half-hour they give an announcement first in what we take to be Rumanian, then in German, then in French and finally in English. The English announcement opens with "Attention Rumanian Radio on 32.4 station, this is the Rumanian Radio on 32.4 m and Radio - 7 on 48.3 metres." They then ask for reports as to quality and strength of signals which should be sent

Bluman to Radio Australia, this station announced that all transmitters of the Forces network would close down on February 29 and, as from March 1, the Forces programme would be carried out on 7.80 mc and 6.08 mc. As we mention above, they are actually on 6.075 mc and their announcement is now "Your Forces Service, South Palestine." Schedule of this station is 2.30 pm to 4.30 pm, and 6 pm to 7 pm. We presume the call letters will still be JCKW.

PHILIPPINE ISLANDS.—Station KZFM, which is known as the "People's Station," is having rather a hard time to find a suitable frequency in the 31 metre band. Readers will remember that they first opened up on 9.515 mc and a few weeks ago they opened up on 9.575 mc and, at time of writing have made another move, this time to 9.62 mc, which seems to be the best spot so far. In addition to this latter frequency they are now also using 6.17 mc and 11.84 mc, neither of which is much use at our location; the former is right on top of YDA2. We have had no luck with a verification from this one yet and would appreciate hearing from anyone who has.

ECUADOR.—Quite a few of our regular listeners have reported hearing HCBJ operating on a frequency just slightly less than 6 mc. We understand that it has been heard in the afternoons till just after 4 pm in special programmes, but the best time to hear it is from 9.30 nightly, when it opens up in their Spanish programme. We have measured the frequency as 5.96 mc and it is certainly not on its assigned channel of 5.99 mc. It can easily be recognised as in addition to giving their call letters they also announce their well-known slogan, "La Vox de los Andes." This station has always been a good one for verifications and here is a chance to obtain another for your South American list.

to some address which we were unable to understand. This looks as if there is now a tie-up between Radio Liberta and the normal outlet on 9.25 mc, possibly a result of local events.

GREECE.—Our Junior Section Contest winner, Mr. R. Block advises that he had heard Athens on 7.95 mc, giving a news session in English at 2.30 am. The station identifies itself as Athens National Broadcasting Station and gives their address as National Broadcasting Institute, Athens, where reports should be sent. While listening to the DX session from Radio Australia we also heard details of this station, but we think the frequency was announced as 7.255 mc, which is their old channel. We have not had an opportunity of making a check, so cannot say which frequency is correct for this new service. Listeners should therefore check both channels and we will be interested to hear which is correct.

VENEZUELA.—Two stations only from this country, YV5RY on 4.275 mc, and YV5RM on 4.97 mc, both located in Caracas. Listen for both of these around 9 pm when they are quite good except for rather high noise level, which is typical of this band.

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QLD. Electronic Industries Imports
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MAKING A 144 MC. CONVERTER

Continued from Page 31.

th the HT off the converter. This due to the loading effect of the ate resistance of the 6J6 upon the ansformer winding.

The next step is to set the frequency and the range of the oscillator portion. It may be set to tune the high or low frequency side of the signal channel, but the latter makes it easier to achieve the desirable high C/L ratio in the interests of stability.

This means that the oscillator must be from 131 Mc. to 135 Mc. In order to cover the band. In our use, the plates of the "butterfly" condenser were spaced so as to give a tuning range of from 130 Mc. to 136 Mc., which means a carrier wavelength of from 143 Mc. to 149 Mc.

Half a megacycle "clearance" at each end of the band is really quite efficient and, furthermore, devotes more of the 90 degrees of dial range to the actual band.

The oscillator frequency can be set by trial and error, although the problem is simplified if you have access to a calibrated signal source and a receiver capable of tuning in that region. The super-regenerative receiver featured in the October, 1947, issue of R. and H. was actually used for this purpose. The 3-turn coil was replaced by a 4-turn coil

in order to "get down" to 130 Mc. or a little lower.

CALIBRATION

The dial of the super-regenerative receiver may be calibrated with the aid of harmonics from a signal generator or from the local oscillator in the communications receiver. In the latter case, it is merely a matter of knowing whether the local oscillator is on the high or low side and then adding or subtracting the intermediate frequency from the main dial calibrations, so that its fundamental frequency may be established.

Identification of the order of harmonic is possible by retuning the receiver to adjacent known frequencies which produce a harmonic on the same spot on the super-regenerative receiver dial. Naturally, by moving to the lower frequency, the harmonic would be of the next higher order.

Obviously, harmonics from a signal generator may be identified in the same manner.

A still further method of calibrating the dial on the super-regenerative receiver would be to use a set of Lecher lines and couple them through a half-turn loop to the superregen. tuned circuit.

Set the receiver control to a position just beyond where super-regeneration commences and move the shorting bar on the lines until a position is found where the receiver goes out of oscillation. By adjustment of the coupling of the lines to the tuned circuit, this point can be made to be quite sharp. With length of lines which are just under one wavelength long at 130 Mc., two points will be found where the superregen. goes out of oscillation. These two points are a half wavelength apart and, hence, by measurement of this distance, the frequency to which the receiver is set may be calculated from the formula:

Frequency (in Mc.) =

5905

Length (in inches)

With the coil data and the condenser values given, the converter oscillator should tune all or part of the desired range of 131. to 135 Mc. with the 3 to 30 mmfd. trimmers set approximately half-way into mesh.

Locate the oscillator by setting the "butterfly" condenser at maximum capacitance and then tuning its signal in on the superregen. receiver. Set the "butterfly" to minimum capacitance and attempt to tune in the oscillator signal again. If no signal is heard, the chances are that the circuit slipped out of oscillation. It will be remembered that

(Continued on Page 94)

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Attenuation 1 M/c.	.41	.22	.6	.31	.16	.28	.16	.5	.3	.15	
db. per 10 M/c.	1.3	.72	2.0	1.0	.52	.9	.55	1.5	.9	.4	
100 feet 100 M/c.	4.2	2.3	6.5	3.4	1.7	2.9	1.8	5	3	1.35	
Loading 1 M/c.	1.5	5	.5	3.5	7	4	5	1	3	4.3	
Kw. 10 M/c.	.5	1.5	.2	1.0	2.2	1.2	1.5	.4	1	1.6	
In Air 100 M/c.	.15	.5	.05	.35	.7	.4	.5	.1	.3	.5	
Capacity uuF/ft.	24.5	32	29	21.5	21.5	22	19	18	10.6	4.6	
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THE HAM BANDS WITH MORE RELEASES

Federal Convention Notes—Phone Assignments—Overseas Licences—UHF'S—QSL Bureaux—ARRL DX Test—Personal

W.I.A. FEDERAL CONVENTION

THE most important event in amateur affairs each year is the Federal convention of the WIA.

The 18th Federal convention of the WIA was held in Melbourne on 26th to 29th of March. Delegates from all States were in attendance; J. M. Moyle, VK2JU, for NSW; H. Stevens, VK3JO, Victoria; F. M. Nolan, VK4FN, Queensland; H. L. Austin, VK3AW, S. Australia; G. Moss, VK6GM, W. Australia, and J. Brown, VK1BJ, Tasmania. Mr. G. Glover, VK3AG, was chairman in the absence of Mr. W. Gronow, VK3WG, Federal President, who was unfortunately ill. The Federal secretary, W. Mitchell, VK3UM, acted as secretary.

The convention discussed and voted upon 52 items of the agenda paper and over 20 items of general business. The decisions will be publicised when the official report is released.

The Federal organisation of the WIA is an extremely democratic set up and its workings are not always clear to the average amateur.

The following is a brief outline of the machinery for organising Federal conventions.

The first move is a call from the Federal executive to State divisions for agenda items to be tabled at the convention.

On the receipt of these items the Federal executive arranges and lists the items, and it is this list that becomes the business paper for the convention.

The paper is then sent to all divisions who instruct their delegate how to vote on each specific item. Delegates are usually briefed at a general meeting of the division. When the State delegates are gathered at the convention it is necessary for the majority of the States to be in accord, before any agenda item be accepted as Federal policy.

You have firstly a majority of members of the general meeting in favor of the item and secondly the majority of States in favor, before any item is voted for action. This cross-section of Australian wide opinion can be accepted as an extremely democratic method of formulating Federal policy.

PROPOSED NEW U.S. PHONE ASSIGNMENTS

THE point that probably raises most discussion in amateur circles, is the vexed question of Phone v. CW. Opinion is very divided and it is often hard to reconcile oneself with the extreme views of some on both sides.

Of great importance to amateurs throughout the world are the deliberations of a special planning committee set up by the ARRL. Under the chairmanship of W4DW, the committee is formulating

ARRL policy on proposed extensions of American phone bands.

Every KC of additional W phone spectrum on DX bands, is one KC less of useful space for foreign amateurs. Sixty thousand amateurs in America provide a complex problem in interference, that has no ready solution.

A poll is also being conducted among American amateurs, to obtain nationwide opinion on phone band extensions. The report of the planning committee and the result of the poll will be presented to the ARRL board of directors, for their deliberation.

The main points affecting each band as suggested by the planning committee, are as follows:

3.5mc.—extension of phone assignment by 50kc., 3800-4000 kc. and an additional 50kc., 3750-3800kc., for Canadian stations.

7mc.—The committee decided against any telephony segment in this band and it is to remain exclusively CW. It is the most popular UHF band and to introduce telephony on the band, would encourage foreign phones to fill the remaining portion to the detriment of American CW stations.

14mc.—The present assignment 14200-14300 kc. to be extended to 14400kc., until the Atlantic City assignments are introduced and then revert back to 14350 kc., an effective final increase of 50kc. Canadian band to begin at 14150kc.

21mc.—No immediate action to be taken as the band will not be released, until about September 1, 1948.

Out of the allotted band width of 50kc., the following assignments are suggested: 150kc. American phone (B class licence operation included), 50kc. Canadian phone and allowing 75kc. for the use of foreign phones, leaves 175kc. for CW operation.

28mc.—No changes are suggested for this band.

OVERSEAS LICENCE CONDITIONS

HERE in Australia we have endeavored to keep restrictive regulations on amateur activity to a minimum. Regulations throughout the world vary greatly. New regulations have been adopted as from January, 1948, in Argentina.

Latin American States have always been extremely lax in their licensing laws and the new LU regulations tighten things up somewhat.

Classes of licences are three in number. First class includes all amateurs licensed before 1941 and over 35 years of age, and the second category those persons who pass a 10 wpm. Morse test and an examination in theory and regulations (the equivalent of our ACP and a new departure). First class ticket holders can use all bands available to amateurs.

Second class licences include all amateurs licensed before January, 1948, and the requirements for a ticket include theory and regulations, but no Morse!!

Third class licences are available to those persons who pass an examination in elementary theory and regulations, and can be sponsored by either, a recognised radio club, a first class operator, or have the required educational qualifications. They can only operate on the 5 or 70 metre bands and with inputs limited to 40 watts.

From the above it will be seen that it is far easier to qualify there as some form of amateur than in Australia.

THE UHF'S

LITTLE can be said on unusual working during March. Sporadic E DX practically nil and 2GU was reported only once further than Sydney—March 31, 1930 hrs. S6 by 2ADT, 2GU calling 3ML portable.

On 166, 2BZ and 2ADX have linked Newcastle and Maitland, S8 signals both ways.

2WJ and 2VW took 166 MX gear up to 2RU at Gosford and later, Major had a two-way contact with Sydney. Sir then, working between Sydney and Gosford has been spasmodic, with very great variations in signal strengths. Cloudy nights seem to be the best time.

April NSW UHF meeting saw some interesting discussion on UHF matters. It was decided to use horizontal polarisation on the new 14mc. band in the Sydney and Newcastle areas.

A paper was presented by Mr. Allen Bird, VK2QW, on Antennae for the UHF's. Horizontal polarisation and the circular halo type of antenna were subjects discussed at length.

The Radio Research Board is interested in reports on unusual conditions on the UHF bands, especially on sporadic E reflections. Reports should show, date and time, location from which signals are received and signal strength, starting and closing times of the unusual conditions.

Mr. Fred Carruthers, VK2PF, was appointed to receive these reports and he will co-ordinate same and forward on to the RRB.

Since writing the above, 6 opened up to South Australia from 2145 to 2200 hours on April 7. 2LY worked 5QR 5RJ and 5L, 2WJ-5RT and 5QR, 2YR-5RT and 2ADW-5QR.

QSL BUREAU

A FACT not known to many amateurs is that a number of national societies do not handle QSL cards for non-members. The South African society is one example. It is rather difficult to tell from a contact, whether a station is a member of his national society—so if he requests a direct QSL and you want his, send it by mail direct.

Most national societies, although they are under no obligation to do so, handle non-members' cards.

Here in Australia the WIA extends the courtesy to non-members of forwarding their inwards cards on the receipt of a stamped envelope. To members QSL services are free, except for a charge of halfpenny for overseas outwards cards.

ATLANTIC CITY BAND RELEASED

THE PMG's Department has announced the release of the 144 to 148 mc. band. It was not anticipated that any of the UHF bands would be released until later in the year. This new band replaces the present 166 to 170 mc. band. In the US, distances over 500 miles have been covered on 144mc. with directive arrays and under favorable conditions, it should prove a very fine band for UHF enthusiasts.

For the benefit of amateur listeners, the following is a complete list of amateur bands available for use from May 1, 1948.

3.5-3.8 mcs., 7.0-7.2 mcs., 14.0-14.4 mcs., 27.185-27.455 mcs., 28.0-30.0 mcs., 50.0-54.0 mcs., 144-148 mcs., 1345-1425 mcs., 2500-2700 mcs., 5250-5650 mcs. and 10,000-10,500 mcs.

WIA NEWS

MARCH NSW Divisional meeting with John Moyle, 2JU, in chair, saw much animated discussion on the 52 items of the Federal convention agenda paper and finally the delegate was briefed. The council was gratified to note the number attending and taking part in the discussion.

Noted—fine work by Wal Nye, 2XU, NSW secretary, and Brian Anderson, 2AND NSW treasurer, who both took over difficult jobs and have them now well under control.

The following NSW amateurs have accepted nomination as councillors for the NSW Divisional Council—V. Cole, VK2VL,

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J. B. Corbin, VK2YC, L. D. Cuffe, VK2AM, R. Dowe, VK2RP, K. Handel, VK2IA, C. Hicks, VK2ADV, C. D. Hutchison, VK2YP, N. Macnaughton, VK2ZH, M. H. Meyers, VK2YN, J. Moxie, VK2JU, A. Thurston, VK2AV, and F. Treharne, VK2BM. The above gentlemen by nominating for election have signified their willingness to work for the general benefit of the amateurs of NSW.

ARRL DX TEST

THE 1948 DX W. Test passed by without many serious efforts by Australian amateurs. The main problem being the lack of publicity—QST takes nearly two months to reach us these days and it has been suggested to the ARRL that the publication of the rules in QST, be advanced a month.

In the CW section, Vince Bennett, VK2VA, attained the grand total of 1100 contacts in two weekends. We heard, however, that Dave, 2EO, headed him with a multiplier of 62 out of a possible 72, even after spending time off to visit hospitals. Dave only wants this year's BERU contest to complete the double of VK-DX, WVE and BERU for two years running.

2YC after QSL Duties and general WIA telephone queries managed 260 contacts.

PERSONAL AND DX

VR6AY Pitcairn has a companion in VR6AB, 14120 T8, 1600 hrs.—was driven off by a VFO attack on Saturday, March 20. Rare ones HL1AO, 14130 T7, and LZ1BC, 14035, 0100 hrs.

During the last month commercials have had a field day on 20—about 50kw. of ICW was tuned up on one occasion; March 20, PFE spent hours calling VP4V

BLUEPRINTS are now available showing the chassis and panel layout for the 5in. C.R.O., together with the minor mounting brackets. Cost of the blueprints is 2/6 each, making 5/- for the set. Chassis blueprints are also available at 2/6 each, for the universal tuner chassis and the "Fidelity Five" receiver.

with a chirpy signal. The best one was 7AW T2, 40kc. spread, calling GKM. Half the time these chaps seem lost, pity they were not as frequency conscious as the average ham and as for signals, looks as if they should have a probationary period.

AP is the new prefix for Pakistan—AP2C on quite a lot, HL possibly new prefix for Korea—HL1AE very active. YN1AC and CT3AB survived the best VFO attacks. It is a pity our friends, the W's, didn't stop out a bit longer, 20 was a pleasure to operate on while they were absent.

VK1AA returned on April 1 after 55 days at sea. He was extremely busy on the last couple of days, trying to cope with all the calls.

Earl Williams, VETALE, who was in VK with the special Canadian signals unit, wants to contact old Australian friends. The W's have a name for him, "Round-table termite."

Handy in QST Feb, is quite hostile on sharp DX contest practices—latest is to use assistant ops. to spot the DX for you and line up the choicest DX. DX contest rules are fairly broad, so please don't use the "bush lawyers" interpretation, weigh it up and use your better judgment.

WIA SUB-DIVISIONS

AN item agreed to at the Easter Convention, and yet to be ratified by the Divisions, refers to the setting up of

Institute Sub-Divisions where these are considered to be justified.

The present method of decentralising Divisional administration is to divide each Division into a number of zones, each under the control of the Division concerned, and each supervised by a zone officer nominated by the Division or the Divisional Council. This officer is responsible for co-ordinating activity within his zone when such co-ordination may be required.

The main purpose of the zones, therefore, is to provide a central point for local activity, and they are particularly valuable in larger States, such as NSW and Queensland, although at the moment, Victoria has possibly the most advanced zone organisation. Some of these zones

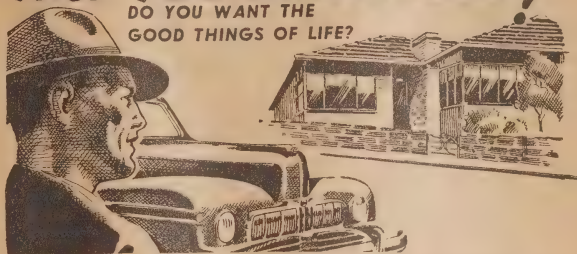
include large numbers of WIA members. It has been felt for some time that where numbers are large enough, sub-divisions might be supported.

A case in point is the Newcastle and Coalfields zone in NSW. Something like 100 Institute members live in this zone, which has always been a loyal and active area.

The granting of sub-divisional status to this zone will undoubtedly help to knit these members more closely together, and help them to foster WIA ideals as undoubtedly they wish to do.

This new sub-divisional idea is to be included in the uniform divisional constitution now being considered by Federal Executive, and it is anticipated that all Divisions will ratify it as being a necessary part of institute organisation.

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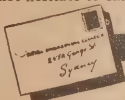
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OFF THE RECORD — NEWS & REVIEWS

There is every indication that in the future — we hope the near future — records will be available using new materials which will allow greatly improved reproduction and much lower needle noise level. They will probably cost more than present types, but will be welcomed with open arms by record buyers.

RECORDS of this type made in England have already been demonstrated in Sydney by Sir Ernest Fisk, who brought some samples out with him for the purpose. Those who have heard the pressings are unanimous in their opinion that they represent a big step forward.

The present "shellac" type of record has given great service, and is still able to do well for records where the highest fidelity is not required. The extension of the recorded frequency range, which, as we pointed out in a recent article, is the highlight of modern technique, demands a material not only better, but different in nature.

The latest types of pickups are using permanent "needles" usually dipped with material, such as sapphire, not only for the added playing life, but because, from almost every point of view, a cleaner, better tip is possible than with steel.

Present records contain a certain amount of abrasive, the function of which is to grind the steel needle point to fit the record groove. The presence of this abrasive makes a certain scratch level

By JOHN MOYLE

almost unavoidable, and it certainly is not required where sapphire points are used.

The new records, therefore, will be made with little or no abrasive, which is one reason why the scratch level is low. It can be made so low that frequencies well beyond the audible limit can be recorded, without being swamped by the scratch from the record surface.

The new material, it is understood, can be used with present matrices to give the same recordings with immeasurably cleaner surfaces, and will allow still better and wider range recordings to be made.

The new move has all the earmarks of being the biggest advance in reproduction since electrical recording. No dates have been announced for release, but as high grade radiograms are already appearing on the market, it is reasonable to imagine that no time will be lost.

WILLIAM KAPEL (pianist) and Bos-

ton Symphony Orchestra, conducted by Serge Koussevitzky—"Concerto for Piano and Orch. (1936)" (Khatachaturian) HMV. ED.629/32.

Kapell played this concerto when he was in Australia a year or two ago, and it was received with considerable enthusiasm. It is music of today, if it may be so described, for to call it "modern" would, I think, be to give a wrong impression. It is modern in that it is not strictly classical, but there is a cohesion, a ready intelligibility, and a form to it which is not to be found in many works labelled rather loosely as "modern."

It is in three movements of more or less conventional types, and it has subjects which can be recalled with little trouble both initially and in development.

On that general form, the composer has written a most amazing piece of work, one including a brilliant procession of color and rhythm into which is woven piano music of a type which can only be described as enthralling. The material is always interesting, but it is the treatment of it by which the concerto stands or falls.

It is, in fact, exactly the task which Kapell tackles with the utmost enthusiasm, and in which his great talent shows to best advantage. He is without doubt in the front rank of pianists where sheer technique and incredible accuracy are coupled with speed, and he has plenty to occupy him in this score. I am, in fact, hard put to it to recollect any recording which presents such marvellous keyboard feats. If he has not the maturity and experience of Horowitz, he is little if any inferior in brilliance and execution. And those of you who have heard this great pianist at his best will realise that this is no faint praise of young Kapell.

It will be highly interesting to note by future recordings—and let's hope there will be some—just how he develops as a pianist. Horowitz, whose early fame came to him for much the same reason—his amazing keyboard virtuosity—added to his stature to such an extent as to produce that magnificent recording of the Brahms Concerto No. 2. Whether Kapell can do the same is a matter for time to tell. At least he has a technical advantage which few living pianists can equal.

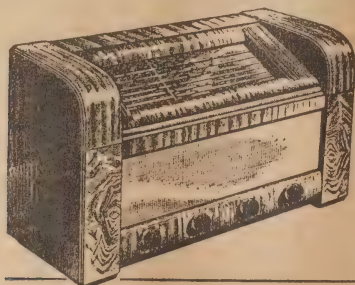
Bearing in mind the great demands on the recording engineer, the records play extremely well. There are very few uncertain moments, and they are not important. Played on a good machine, the effect is certainly "thrilling," to quote from the Supplement leaflet.

YEHUDI MENUHIN, Violinist and Liverpool Philharmonic Orch., conducted by Sir Malcolm Sargent—"Concerto in A Major," K.218 (Mozart), HMV. ED.633/5.

This is one of the most beautiful of Mozart's violin concertos and probably one of the best known. It requires in full measure all the delicacy and understanding of Mozart which a fine musician can muster.

In general terms, the performance is successful in these things. It is not "Beecham" Mozart, which, by reason of the numerous Beecham records, has become familiar to many record lovers. It is not as romanticised, nor it is quite so carefully and meticulously phrased. It is more the substitution of Sargent's technique for Beecham's, with a somewhat more realistic approach, if that is exactly the right word. This is offered more as a critical remark than one of censure, for both Sargent and Menuhin know their work too well to fall in producing a performance of real merit.

This is a work where strong violin tone is not required so much as purity and delicacy of touch. Menuhin, in my view, is better suited to work of this type than to other music he has recorded. His tone at times is so fine that it almost becomes thin, but his clean



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dexterous handling of the mar-
 oriental passages is rarely at fault.
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 The beautiful second movement, for-
 and is a fine example of this, show-
 fine control of both orchestra and
 ist. I think, the best of the
 the other two being on about an
 footing.

the recording is good average, and I
 and the records themselves quite easy
 play. I can recommend the set to all,
 one cannot fail to appreciate the
 art highlight, and the soundness of
 performance.

HILADELPHIA ORCH., Cond. by
 ene Ormandy—"The Pines of Rome"
 spighi). COLUMBIA LOX 651/3.

he composer is best known for this
 and its companion, the "Fountains
 Rome," a recording of which was re-
 some little time ago. Whether you
 go for this recording will depend
 ily on whether you like Respighi or
 ether you don't.

frankly programmatic, in that it por-
 trays musical reactions and descriptions
 Roman scenery notable for its pines.
 is doesn't mean that the music is uni-
 ely sombre, or tinged with eternal
 lancholy as generally associated with
 e trees. On the contrary, it contains
 vide and beautifully written comment-
 on all that goes with them—the wind
 e blows through them, the sun that
 nes on them, and even the birds—
 st realistically and inoffensively intro-
 duced—which make them their home.

The Philadelphia Orchestra I have al-
 ys considered at its best with music
 this nature. They are in the front rank
 en it comes to producing musical at-
 sphere and color, and after all, there
 little else to these records. As for
 e recording, it is generally good, with
 ne sections more than good. The work
 is altogether one of my favorites, but
 listened to it with great pleasure and
 approval.

MARGHERITA CAROSIO, Soprano and
 yal Opera House Orch., Covent Gar-
 n, "Ahi Non Credea Mirarti" (Coul
 iave) ("L'Innamorata") (Bellini)
 "O Madre Mia (My Mother) ("Lina"
 onchielli), (Sung in Italian). HMV
 D 638.

A particularly pure and lovely voice,
 d well suited to the romantic type of
 sic represented by these two numbers.
 ie recording is a little doubtful on one
 o notes—with steel needles, although
 plays quite well with fibre types. It
 a pleasure to hear a voice as fresh as
 is one.

MARIAN ANDERSON, Contralto, with
 illiam Primrose, Violinist and Piano
 accompaniment—"Piegie" and "When Night
 escends." HMV, ED.169.

Two well-known songs sung by the
 eatest American contralto or for that
 art, one of the greatest in the world,
 have heard records which I thought
 e successful that this one, but it has
 l the merits of a fine voice and fine
 istrity. Primrose is, of course, well
 own as a soloist and orchestral player.

THE PHILHARMONIC ORCH., con. by
 onstant Lambert—"Street Corner
 erture" (Rawsthorne). (Recorded un-
 der the auspices of the British Council).
 MV EB 413.

Rather a brilliant piece of recording,
 hich must admit rather bewildering
 on an first hearing, as no doubt the
 hirrling of a street corner would be
 expected to do. Other than that, I
 und it a bit hard to find much more,
 though possibly I may mean it
 as a good example of work by a repre-
 sentative of the young English school, and
 ill be well received on this score. It
 competently written, with good feeling
 or orchestral effects. And it doesn't
 rag as I fear many such works do. It
 asn't that manufactured feeling about
 it, but flows with the cohesion of a good
 orkman.

THE MELACHRINO ORCH. Cond. by
 eorge Melachrinio—"Liebestraum"
 Liza and "Winter Sunshine" (Melach-
 rinio). HMV, EA 3636.

These are both good examples of light
 rchestral technique. Liebestraum is not
 eated very heavily, and the "Winter
 unshine" is a pleasant, bright piece of
 e. Ideally suited to the orchestra's re-
 sources. It should do well with those who
 ke the not so heavy.

NBC SYMPHONY ORCH., Cond. by
 rtruro Toscanini—"La Cenerentola
 Cinderella"—Overture." (Ros. Mil). HMV,
 D 639.

Frankly, I find it hard to understand
 why Toscanini spends so much time on
 recording these things, when there is so
 much else he could do. This isn't a
 slight on Rossini's overtures, which are
 in the main, brilliant and pleasant to
 hear. They are also well played, as only
 Toscanini can play them. But when I
 consider how much really fine music he
 has produced for recordings, I grieve
 somewhat that he doesn't leave some of
 the lesser moments to others. Whatever
 you may think about him as a con-
 ductor, you will appreciate his pre-em-
 inence in his own field, and agree that
 his impact on the world of music is a great
 one. It's a pity he isn't able to concen-
 trate on music great enough for his
 powers.

This recording is very similar to a
 number of others of this type, and al-
 though it is rather hard in tone, is a
 fine exhibition.

BOYD NEEL STRING ORCH., Cond.
 by Boyd Neel—"Adagio for String Or-
 chestra" (Lekeu), (3 pts.), and "Arioso"
 (From Cantata No. 156), (Bach). COLUM-
 BIA, LBDX.11/12.

One of those typical recordings we
 have come to expect from the Boyd Neel,
 and although the Adagio is not familiar
 to me, it is particularly beautiful, and
 well described. The Arioso is known
 to almost everyone, and is adequately
 performed. More than this, it is almost
 superfluous to say.

MORTON GOULD AND HIS ORCH.—
 "The Very Thought Of You," and
 "Dancing in the Dark." COLUMBIA.
 DOX 918.

These are played in the symphonic
 style which characterises quite a number
 of orchestras nowadays, and the ar-
 rangements are in their way effective
 and novel—"the same, only different,"
 if I may describe it that way. Both num-
 bers are rather above average in quality,
 and the net result is quite good.

QUEEN'S HALL LIGHT ORCHESTRA.
 Conducted by Charles Williams—"The
 Night Has Eyes," and "The Runaway
 Rocking Horse." COLUMBIA DO 3111.

Well played light numbers with some
 nice recording to help them out.

RICHARD TAUBER, Tenor, with Orch.—
 "In the Ballroom" (Tchaikovsky), and
 "We'll Gather Lilacs" (from "Perchance
 to Dream"), (Novello). Parlophone.
 AR 400.

It won't belong now before the last of
 the Tauber records will be released—for
 that reason alone, each new release will
 be greeted with added interest.

These are both typical in performance
 —I liked the first-named best, the sup-
 port being rather slighter in substance
 and melodious in the Novello manner.
 Quite a good record.

OTHER RELEASES INCLUDE

H.M.V.

DESI ARNAZ AND HIS ORCHESTRA.—
 "I Love to Dance," and "A Rainy Night
 in Rio." EA 3659.

SAMMY KAYE AND HIS ORCHESTRA.
 —"Where is Sam?" and "Don't you Love
 me Any More." EA 3660.

DENNIS DAY WITH ORCHESTRA.—
 "You Keep Coming Back Like a Song"
 and "Mam'selle." EA 3661.

HIS MAJESTY, KING GEORGE VI.—
 "A Message to the British Empire"
 (Broadcast on Christmas Day, 1947). (2
 Parts). REB 436.

TOMMY DORSEY AND JIMMY DOR-
 SEY—"The Dorsey Brothers Concerto"
 (Pts. 1 and 2). EB 437.

SAMMY KAYE AND HIS ORCHESTRA.
 —"Hand in Hand" and "I Used to be Her
 One and Only." EA 3662.

TEX BENEKE WITH THE MILLER
 ORCHESTRA.—"How Can I Say I Love
 You," and "A Girl That I Remember."
 EA 3663.

HELEN CARROLL AND THE SATIS-
 FYERS.—"Oh Why, Oh Why, Did I Ever
 Leave" Wyoming," and "Russian Lullaby."
 EA 3664.

SAMMY KAYE AND HIS ORCHESTRA.
 "That's What Every Young Girl Should
 Know," and "Promises." EA 3665.

JOE LOSS AND HIS ORCHESTRA.—
 "Escapada," and "To A Wild Rose."
 EA 3666.

THE GINGER SNAPS WITH ORCHES-
 TRA.—"The Shrimp Man," and "Juke Box
 Joe." EA 3668.

GLENN MILLER AND HIS ORCHES-
 TRA.—"Let's Have Another Cup O' Cof-
 fee," and "Blue Evening." EA 3673.

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ANSWERS TO CORRESPONDENTS

J.A.B. (Cobar, NSW) is interested in the possibilities of superpersons.

A. Many thanks for your letter which was read with interest. Actually we have never done any work along the lines you mention, although, we are aware that there are great possibilities for experiment in this field. The article to which you refer was copied from an overseas magazine. We agree that there is an element of danger in this work and that every precaution should be taken when appreciable power is used. Many thanks for your congratulations which are greatly appreciated. As you state in your letter "Radio & Hobbies" is not intended to cover such specialised work such as this, which really comes into a field of its own.

R.B. (Tempe, NSW). A regular reader of R. & H. renews his subscription and says that he has built quite a number of the circuits featured in the magazine, but his favorite is the "T.R.F. Fidelity Nine" with its excellent results, frequency response and the tone control which is the smoothest he has handled.

A. Many thanks for your subscription, R.B., which has been dealt with in the normal fashion. In expressing your enthusiasm for the "T.R.F. Fidelity Nine" you join the ranks of many others of our readers who have constructed this set and had remarkable results from it.

A.A.S. (Oralla, via Roma, Qld.) renews his subscription and expresses his satisfaction with the results the "IQ5 Two" with but 30 volts HT supply.

A. Your remittance for subscription renewal has been dealt with in the normal fashion. A.A.S. We agree that you have every reason to be pleased with the results of your little set particularly with South Australian reception at night.

S.H.S. (Lane Cove, NSW) writes in to say that the "6-240" set which he has just completed operates quite satisfactorily, except for slight hash at the low frequency end.

A. We would suggest, S.H.S., that you ensure that the R.F. chokes in the filter network are raised from the metal chassis by insulating spacers, such as small wooden blocks. This prevents the small fields of the R.F. chokes from introducing undesirable eddy currents into the chassis. It would also be wise to ensure that all the points mentioned in the article regarding the elimination of hash have been observed. You contact an advertiser such as Gibbons and Denham, of 122 Darling-St., Balmain.

B.A. (Ivanhoe, Vic.) encloses a circuit of the "Little General" modified to use a loop aerial for comment. He also wishes to use an 80 rectifier.

A. Your circuit is quite in order and should work to your satisfaction. As you would expect a loop does not have as much pickup as the usual indoor type, but nevertheless it should be quite effective at your location for the Melbourne stations.

Most loops have provision for an external aerial, so you could use this if it becomes necessary. Type 80 is an exact equivalent of the 5Y3-G, the only difference being the bases.

R.J.R. (Big Fell, WA) queries the circuit and wiring diagram of the Vibroxov 4-Watt amplifier in the September 1946 issue.

A. Your statements are quite correct. However, as mentioned in the text the interference problem varies widely with each individual amplifier and often a little experiment is necessary to achieve the best results. We suggest you follow the circuit diagram on page 29, and only install the extra 0.001 mfd condenser as shown in the wiring diagram if vibrator hash is apparent.

C.A.P. (Tamworth, NSW) is interested in sound on film.

THE following reprints are available on application at our office, 60-70 Elizabeth-street, Sydney. They will be sent, post free, on receipt of stamps or postal notes.

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A. The issue of Radio & Hobbies covering this subject is now out of print, and we can only suggest you advertise in the "Wanted To Buy" columns. Angus & Robertson of 89 Castlereagh-street, Sydney, would be glad to forward you a list of the available books dealing with the subject and we suggest you write to them.

C.W.L. (Essendon, Vic.) expresses his appreciation of our magazine and reports success with Monty plus an audio stage. A. Your letter is very much appreciated C.L., as we like to keep in touch with our readers and hear of their wishes. Radio is a grand hobby, and there is a lot of fun to be had even with the simplest of sets. We try to provide something of interest for all tastes, from beginners to the fairly advanced enthusiast. Even though in your case it appears to have been successful in curing some hum, we do not recommend connecting a 0.05

mfd condenser from one side of the power transformer primary to earth. This condenser has a low reactance at 50 cycles and under certain conditions it would be possible to get a shock from the chassis. As an alternative you could try connecting .001 mica condensers from each plate of the rectifier to earth. Also make sure that the electrostatic shield of the power transformer is earthed. You rest assured we will be considering a design of another three or four valves set before very long.

J.K. (Glen Iris, Vic.) expresses his appreciation of "Radio & Hobbies" and as a number of questions in connection with a B/C receiver he recently built up.

A. Ordinary potentiometers intended for receiver use are tapered to give smooth control when turning the knob in clockwise direction to increase the volume. If the connections were reversed, the control would be very critical. You must return the "cold" end of the potentiometer to the cathode of the 6BB6, to earth as shown in your diagram. The gain of your audio amplifier is very high and we suggest you connect a 1.0 megohm resistor directly between the plate of the EL3-NG and the plate of the 6BB6. Occasionally a valve will operate satisfactorily without a grid return resistor, but under most conditions, this would lead to hum and instability and high plate current. Trouble could almost certainly be expected in the long run, and the resistor should be always included. The popping noise at the low frequency end of the broadcast band may disappear with the addition of the resistor suggested above. Some tendency to instability is usual without an aerial connected to the set. You have given no indication of screen bypass condensers for the RF and IF amplifier valves. These should be included and should have a value in the vicinity of 0.1 mfd. It is quite in order to use a common earth busbar for various stages of the set. The usual procedure is to bolt a number of solder lugs at strategic points on the chassis and then run the busbar between them which makes absolutely sure of the earth connections. The grid bias on the RF valves can be measured by connecting a voltmeter across the cathode bias resistor of the valve concerned. A value between two and four volts would be necessary.

L.K. (Maryborough, Vic.) sends in his subscription and at the same time reports that he has built up both pendulum and synchronous clocks from R & H and that both are keeping perfect time.

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3. Back numbers are rarely available but reprints of most circuits, wiring diagrams, and parts lists will be supplied for 6d each, minimum charge 1/-. Thus a circuit, layout, and parts list will cost 1/6 in stamps or a postal note. Endorse envelope "Circuit."
4. Blueprints of exact size chassis layouts with all essential holes and cut-outs will be supplied if available for 2/6. Endorse envelope "Blueprint."

Address your letters to the Technical Editor, "Radio & Hobbies," Box 2728C, G.P.O., Sydney.

ANSWERS TO CORRESPONDENTS

Your subscription has been attended and you can rest assured of receiving your copy each month. We are glad to see your success with the clocks. C.C. (Hurstville) has on hand some meters and would like to know their prices. Also, he has been unable to find the glove fasteners for the 67.5 volt Max batteries.

A. The first resistor you list is evidently led in some non-standard manner and are at a loss to identify it. A yellow body with black end and no dot indicates 400,000 ohms, the red body and green 12,500 ohms and the orange body with black end 30,000 ohms. A reprint from February, 1947, issue fully explains the E.M.A. resistor color code is available through our shilling query service. The glove type fasteners have been in short supply for some time and one often has to resort to soldering the wires directly to the battery terminals.

G.J. (Canberra, ACT) requests one or more articles on the subject of frequency dividing networks or two channel amplifier systems.

A. We are interested in this general subject, but it is doubtful whether an article just now would be of much use. Due to the fact that suitable speakers have been almost unobtainable. However, thanks for the suggestion, and also for an advertisement which has been attended.

J.L.B. (Brisbane, Qld.) says he has made a slight modification to the "Two Valve Set for Headphones" which has resulted in improved performance.

A. The addition of the resistor to the menu would merely increase the plate load on the second audio amplifier reducing the plate load. In the normal way this would not increase the volume. We can only assume that there is some special circumstance in your receiver which brings this about in most cases we would expect it to have the opposite result.

G.N. (Hawthorn, Vic.) writes in, after general invitation, with his ideas for the subject of matter to be covered in the sections for the beginner.

A. We can see quite clearly, G.N., the points which you raise and agree with you that they are of considerable interest to the amateur constructor. However, we feel that descriptive articles, whether they be on theory or on constructional details, must initially be given some definite sequence to be of real value to the newcomer. Furthermore, we intend to assist the beginner to use or employ components already on hand, but also to permit him to make his own decisions and draw his own conclusions regarding circuit.

In the matter of construction. Additionally, it is futile to go to great lengths to say that the use of this component and that component is universal without explaining in simple language when and for what reason. Only when plain reasoning is given in support of general statements will they be remembered, to the advantage of the individual. Summarising the idea is to present a simple and easily assimilated theoretical background to the associated and ensuing constructional discussions and thus provide the reader with a basis from which he can do some logical reasoning.

R.P. (Toorak, Vic.) wishes to use a 6MA power transformer and an EL33A in place of the components specified in the valve regenerative receiver described in the Short-Wave Handbook.

A. The total plate and screen current in the EL33A under normal voltages is 0.05 amp. You could operate the valve with increased bias to reduce the current drain. A 175 ohm cathode bias resistor would be suitable in your case. The 2000 ohm dropping resistor in the high tension lead should be reduced to 500 ohms to compensate for the lower voltage delivered by the transformer. Somewhat higher gain can be expected from the EL33A since this valve has a higher transconductance than the 6V6-G used in the original set. Because of this there may be a tendency towards parastics and we suggest you include a 0.000 ohm stopping resistor in the grid and right at the valve socket.

P.D.K. (Mt. Morgan, Qld.) encloses 2/- for copy of the S/W Handbook. He would like to see more technical articles, rather than popular science and articles of general interest in Radio & Hobbies.

He also enquires about a table for converting meters to kc/s and vice versa.

A. The Handbook will have reached you before you read this. Many thanks for your suggestion. Reallocating more space to technical articles. However, a great deal of interest is shown in the hobbies section of our paper, and it is a matter of allotting a due proportion to each section on its merit.

We remember seeing a table such as you require in the Radio Trade Annual, but the conversions are quite easily calculated. Just remember that radio waves travel at 300,000,000 meters/sec. To find wavelength when frequency is known divide the speed of propagation by the frequency or in the reverse case divide the velocity of propagation by the wavelength. Note that all quantities must be in their fundamental units, i.e. cycles/sec., meters, meters/sec.

N.W.F. (Longwood SA). Many thanks for your subscription and kind remarks. A copy of the "Short-Wave Handbook" has been forwarded to you as requested.

N.H.S. (Highgate Hill, Qld.) Your new address has been noted and E & H will be forwarded to you as requested. As usual. Many thanks for your kind remarks in regard to our magazine.

A.R. (Kurri Kurri, NSW) is very pleased with the results he has obtained from a crystal set the circuit of which appeared in our "Reader Built It" page.

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A. Glad to hear of your success with the little set. There is quite a lot of fun to be had in experimenting with crystal sets, and one has the satisfaction of knowing that it doesn't cost much money. A good deal of interest has been shown in the beginners' page, and you can look forward to seeing this feature every month.

M.C.P. (Waverley, NSW) writes in suggesting as an idea for an article a general dissertation on how the serviceability of components found in the junk box may be ascertained.

A. Thanks for your idea, M.C.P. Believe it or not, the subject in question is scheduled for inclusion in the series of articles for the beginner before very long.

P.D.G. (Colac, Vic.) sends in for a copy of the "Short-Wave Handbook" and expresses his approval of the beginner section. He would also like to see further articles on aeriels.

A. You will no doubt have received your copy of the Handbook before you

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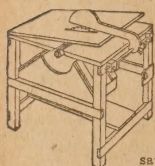
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A SIMPLE 144 MC. CONVERTER

(Continued from Page 87)

the ratio of the capacitance of the 3 to 30 mmfd. trimmers more or less adjust the oscillator feedback voltage, since they establish the apparent tapping point on the coil.

We found the optimum setting to be with the two trimmers at settings which differed by a fraction of a turn only and approximately half-way into mesh.

Keeping, roughly, the same ratio, these shunting trimmers can be juggled so that "butterfly" tuning range is where you want it.

In adjusting the mixer grid circuit to the 144 to 148 Mc. channel, the oscillation from the super-regenerative receiver can be used or the third harmonic from the local oscillator of a 50 Mc. receiver, if this oscillator happens to be on the low side of the 50 Mc. band. On the other hand, if one is unfortunate enough as to be residing in a noisy area, electrically speaking, of course, this circuit may be adjusted to resonance by listening for increase in noise level. Automobile ignition interference is also handy in this respect.

Starting off with two turns in the aerial coupling coil, it should be possible to tune in some signals in the evenings, when activity on the band can be expected.

It is worth while experimenting with the coupling of the aerial and grid coils to obtain the best signal-to-noise ratio. Actually, the number of turns in the aerial coil will depend upon the type of aerial feeder used. In our case, with 55 ohm coaxial cable, the aerial coil consisted of one turn tightly coupled to the grid coil.

A certain amount of oscillator "pulling" will be noticed when attempting to "peak" the mixer grid circuit on a signal. This is more or less unavoidable but, by "rocking" the oscillator tuning while peaking the mixer circuit, the desired condition may be reached.

You may notice one or two strong carriers as the oscillator range is tuned. These will be harmonics from the communications receiver local oscillator. By establishing the fundamental frequency of this oscillator in the manner mentioned earlier, this fact may be confirmed. An appropriate small change in the frequency of the converter IF channel will probably shift them out of the way.

It is also worth while experimenting with the coupling coil of the output transformer. Slightly better gain may be realised in some cases by reducing the number of turns and increasing the degree of coupling.

One final point: The combination of this converter with a superhet. will result in a very selective receiver, which requires careful tuning and a good dial. Its inherent selectivity also makes it rather unsuitable for listening to modulated-oscillator transmitters, owing to their inherent frequency modulation.

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RADIO AND HOBBIES FOR MAY, 1948

A SUPERHETER TUNER

(Continued from page 65)

and, if the coils are fitted with variable slugs, adjust aerial and RF slugs for maximum output. If the coils are of the fixed inductance type it will have been necessary to use a 455 kc variable padder, which must be adjusted at the low frequency end of the band in lieu of the lugs.

Variation to the padder setting shifts the signal, and the idea is to retune the signal each time the padder is altered until the padder adjustment is found which ensures the highest output.

Having adjusted the padder or iron cores at the low frequency end for maximum output, set the dial pointer so that it corresponds to the calibration of any suitable station at the low frequency end of the band.

Then tune a signal at the high frequency end of the band and bring it to the calibrated position by suitable adjustment to the oscillator trimmer. The aerial and RF trimmers are then peaked again for maximum response.

If the IF transformers have not previously been aligned with an oscillator they can be adjusted now for best results, while listening to a weak but steady signal. Take note of just what changes are made so that, if necessary, you can return the screws to their original setting and start again.

After all this, the alignment should be fairly accurate, but the whole procedure can be repeated as a final check. The golden rules of alignment are four in number:

- 1—Carry out the adjustments on a weak signal for preference, with the volume control well advanced, so that AVC action does not mask the effect of the variations.
- 2—Adjust the iron cores or padder only at the low frequency end of the band, as you will otherwise lead yourself into hopeless confusion.
- 3—Adjust the trimmers at the high frequency end of the band only.
- 4—Set the dial calibrations at the low frequency end of the band and bring the high frequency stations into position by variation of the oscillator trimmer. If you follow these rules you cannot go far wrong with the alignment and, provided the gang condenser and dial are suitable, the stations should track quite accurately.

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